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Cinematograph Films and the Home Office

RECENT correspondence in the *Manchester Guardian* has directed public attention to a grave risk threatening that general use of cinematograph films in education and research, which has made such rapid and desirable progress in recent years. For it is admitted that the Home Office proposes to bring the smaller sorts of cinematograph projectors, and the films on cellulose acetate base which are commonly supplied for use with them, within the scope of new regulations purporting to be made under authority of the Cinematograph Act 1909 in the interest—so it is alleged—of greater safety for the public.

Now the Cinematograph Act is concerned solely with the use of apparatus "for the purposes of which inflammable films are used": it gives no authority whatever "for securing safety" in the use of any film which is not inflammable. When the Act was passed, in November 1909, scarcely any projectors were in use except those for films of 'standard' 35 mm. width; and scarcely any films were published except on 'cellulose nitrate' base, which is highly inflammable, igniting at about 230° C., and burning with almost explosive violence. It was clearly in the public interest that the use of such a substance in public assemblies and in necessary proximity to an arc-lamp should be strictly regulated.

In 1909, however, this defect of the earlier films was already leading to the provision of a substitute, the 'cellulose acetate' base, which does not inflame at all below a red heat, melts before it ignites, smoulders rather than burns, and often extinguishes itself. The Cinematograph Act accordingly dealt only with projectors using 'inflammable' films. But the 'non-flam' base has even now one serious disadvantage, that it is liable to warp in use, and consequently is not suitable for films so wide as the 'standard' 35 mm. gauge.

For all 'sub-standard' widths down to 9 mm., and consequently for cheap and portable projectors, adequate for school classes and other small audiences, as well as for laboratory work and private entertainment, the 'non-flam' film has revolutionised cinematography, as the Kodak camera with its roll-holder of film negatives revolutionised photography forty years ago. Schools of all grades, laboratories and museums, clubs and churches, have been equipped with

sub-standard projectors; thousands of film exhibitions are given annually with the same freedom as lantern lectures; and many lantern slides, too, are now made on 'non-flam' base, which is both lighter and less fragile than glass. For Kodak negatives the 'non-flam' film has practically driven out the earlier bases, some of which were dangerously inflammable. No accident from a public exhibition of 'non-flam' film has ever been reported: a solitary mishap at Dulwich College was shown to have resulted from the inadvertent issue of an inflammable film from a Government department. The Post Office has now its own film factory and issues 'non-flam' films for public use. The Board of Education allows large sums to be spent to install 'sub-standard' projectors for open use in schools.

The Cinematograph Act, however, did not define an 'inflammable' film; and the Home Office, after leaving sub-standard projectors, with their 'acetate'-base films, unmolested for nearly twenty-five years, has now admitted, under question, that it is intended to "adapt the regulations to present conditions" and that "one of the points to be dealt with is the relaxation, in favour of slow-burning films, of certain requirements necessary for fast-burning films". The implication here is that all films are "inflammable" within the terms of the Cinematograph Act, and that unless and until the Home Office "relaxes" its regulations, any film exhibition is liable to be regarded as a breach of the Act, unless it takes place under the very stringent regulations proper for 'standard' size films on 'nitrate' base.

It is difficult at first sight to believe that there is anyone who wishes to restrict the free use of sub-standard projectors or the general employment of films in private, in education and research, or in places of entertainment other than those larger halls where 'standard' projectors, and (consequently) inflammable films are still indispensable. But the premature glee with which certain newspapers have proclaimed the end of the 'non-flam myth' seems to betray such a desire; and it is obvious that if people can see the kinds of films they desire, co-operatively, safely and at small cost, without 'going to the pictures', it is not very good for interests which at one time had almost a monopoly of the cinema; as professional photographers monopolised photographs and lantern-slides before the days of the Kodak.

It is especially unfortunate, also, that this outcry about 'non-flam' films should have been confused in some minds with the quite different question whether private, social and educational exhibitions should be 'censored' or otherwise controlled in the supposed interests of morality, political orthodoxy, or what are popularly described as 'box-office' considerations. For, whereas 'non-flam' films and sub-standard projectors have until now been free from official interference on the ground of public safety, most authorities responsible for licensing halls for the exhibition of 'standard' and therefore 'inflammable' films, though legally concerned only with the personal safety of audiences, have in fact agreed to permit in their areas only films 'approved' by the British Board of Film Censors, a body which was set up by the film trade itself, shortly after the Cinematograph Act was passed.

This confusion of public safety with public morality has been the weakest point in British film administration throughout. If the public needs protection against improper or subversive films, it would seem reasonable that this should be assured under the laws regulating improper or subversive behaviour in general. If a censorship should be deemed unavoidable, let us have an official censor, responsible to one of the Secretaries of State, not to the 'trade', which has an interest in the matter, and not always a British interest.

Further, if "for securing safety" the Home Office wishes to "adapt the regulations to present conditions", it can make sub-standard projectors as safe and foolproof as their recognised public utility demands, simply by making it an offence, under the Cinematograph Act or otherwise, to manufacture or offer for sale films on 'nitrate'-base of any width less than the standard 35 mm. size. Any restriction or discouragement of the present general use of the sub-standard projector would be a disaster in public education, and also in the many branches of scientific research and teaching in which this valuable piece of apparatus is employed.

The National Institute of Sciences of India

FURTHER details of the Indian Institute of Sciences, to which brief reference was made in NATURE of January 12 (p. 59), are now available. Elsewhere in this issue (p. 441) we print an article summarising the circumstances of its inception and recording the proceedings of the inaugural meeting. The desirability of having in India a national academy has long

been felt, and this found expression a year ago in the appointment by the Indian Science Congress of a strong committee to elaborate a scheme for the establishment of an All-India Academy. It was feared by many that the work of this committee might have been jeopardised by the registration last June of an 'Indian Academy of Science' by Sir C. V. Raman in Bangalore. There were thus three bodies of 'academy' standing in India, the premier society—the Asiatic Society of Bengal—the United Provinces Academy of Science, and the new Indian Academy of Science. Fortunately, the common sense which has always been such a marked feature in the organisation of the Indian Science Congress, has enabled its committee to surmount all apparent difficulties and to secure the adherence of the officials of these three societies to the new Institute.

The Institute, with its headquarters in Calcutta, has received the support of all the most prominent men of science in India; it has started with one hundred foundation fellows, and in the future not more than ten will be elected annually. The fellowship will obviously, therefore, be a much prized distinction and since it is intended later to apply for a Royal Charter, the Institute will in effect become a Royal Society of India. It is not proposed that the Institute should publish a journal; publication will remain as one of the functions of the co-operating academies, which it is anticipated will be increased by the formation of academies in Bombay and in the Punjab. It will, however, issue a Proceedings summarising the papers read before these societies, and it will be prepared to assist them in the publication of expensive memoirs. An annual report, reviewing the progress of science in India, will also be issued, thus reviving on a broader basis that prepared formerly by the now defunct Board of Scientific Advice. The Institute proposes also to organise symposia on subjects of general and scientific interest. A further activity, on which emphasis is laid in the presidential address, will be "to promote and maintain a liaison between men of science and men of letters". Whilst a National Institute of Arts and Letters has still to be formed, the desired liaison has been effected in an indirect manner by the fact that one of the co-operating academies, the Asiatic Society of Bengal, is both an academy of science and of letters.

Of far greater importance, however, in our opinion, are two other functions referred to by Dr. Fermor: (*a*) to appoint committees to which the Government and other bodies can apply for advice, and (*b*) to secure and manage funds and endowments for scientific research. We advocated recently (NATURE, **134**, 789; 1934) the formation in India of a National Research Council, and these two functions, if fully exploited, will in effect make the Institute such a Council. We understand that the Government of India has allocated a grant of 12,000 rupees (£900) per annum to the Institute, and we do not doubt that further funds, from both public and private resources, will be placed at its disposal.

The formation of the National Institute is the most important development in the organisation of scientific activities in India which has occurred since the foundation in 1913 of the Indian Science Congress. It is but fitting that the Institute should owe its inception to this body.

Reviews

Embryology—Biological, Philosophical and Theological

A History of Embryology. By Dr. Joseph Needham. Pp. xviii+274+16 plates. (Cambridge: At the University Press, 1934.) 15*s.* net.

LOVERS of Tristram Shandy will remember that passage in which Sterne gives a cut of his ironic whip at the learned Catholic doctors of the Sorbonne, who in their zeal to save souls had given a very precise account of the principles governing the baptism of unborn children, not forgetting detailed practical instructions for achieving it "avec une petite canule sans faire aucun tort à la mère". The Anglican divine suggested a more embracing method, "of baptizing all the *homunculi* slap-dash" beforehand, which he assures his readers could be done "avec une petite canule sans faire aucun tort au père".

We have here a very good example of the interweaving of theological and biological embryology. The *homunculi* are of course the spermatozoa, in the head of which, certain early microscopists had averred, miniature men had their habitation, ready to expand their preformed anatomy in the nutritive soil provided by the female. Some had insisted that they had actually observed the manikins, others had achieved the almost greater feat of asserting their existence on grounds of logical necessity. (Was it not the great Bonnet,

writing on the allied subject of preformation, who claimed the fantastic doctrine of *emboîtement*, according to which our first parents contained all future generations, after the fashion of Chinese boxes in an infinite regress, as "one of the greatest triumphs of rational over sensual conviction".)

In any case, it was the biological discoveries of the seventeenth microscopists, quite apart from their metabiological speculations, which enabled the eighteenth century Sterne to reduce *ad absurdum* the arguments of the theologians, based as they were upon the facts and ideas of an earlier age.

Embryology is full of such interactions. How could it be otherwise when the recurrent miracle of generation is concerned? Let us remember that it was not until the middle of the eighteenth century that the early stages of development, demanding the microscope for their elucidation, were in any animal adequately described; and not until the middle of the nineteenth that fertilisation was observed, the concept of the continuing stream of life established, and proof given of the essentially equal contributions made by father and mother to the offspring. Yet offspring were all the time being produced. With their production, the gravest questions were bound up—scientific, philosophical and theological. It was imperative to give some answer to these questions, for not only will the speculative itch not be denied, but also far-reaching theories of existence and practical problems of personal salvation hinged upon them. In the absence of any real basis of fact or any framework of established scientific principle, speculation both could, and did, run riot.

Dr. Needham's book, which covers the history of embryology up to the beginning of the nineteenth century, is essentially a history of the invasion of this speculative orgy by hard-won fact and dawning experiment. The invasion has been slow, and now and again, as in the Dark Ages, was hurled far back. But on balance it progresses, until by the early eighteenth century it has established a permanent footing and prepared the way for the increased momentum of its subsequent advance.

Embryological knowledge and speculation are conditioned by their environment. In certain cases, factual advance is shown to depend upon technical achievement. The most obvious example of this was, of course, the advance consequent upon the invention of the microscope. Dr. Needham points out, however, that it took longer than might have been expected for embryology to take advantage of the new tool ready to its hand. Harvey, for example, seems never to have utilised anything but hand lenses. Or the temper of the time may prevent the speculative men of science from utilising the resources available to them. The general contempt in which manual labour and the mechanic arts were held in classical Greece diverted into mere speculation much energy that might have led to real advance. In such periods as the Middle Ages, when the dominance of theological principles prevents the appeal to fact and experiment, and those like the eighteenth century when pure reason is enthroned above the pedestrian senses, men take to the wings of speculation, and distort their thinking with deduction from preconceived principle. We have cited the example of Bonnet. Another is the belief that the shape of the egg will enable one to prophesy the sex of the chick. This is based on the two principles that the circle is the perfect form, and that the male sex is more perfect than the female: from which it inescapably follows that cockerels will hatch from the less pointed eggs.

This overflowing of scientific speculation into abstract principle may have important practical consequences. Aristotle, as is well known, advanced the theory that the mother merely provided the soil in which the seed of the male might grow and develop. Dr. Needham points out the bearing of this view on the growth of the patriarchal system of social organisation, and on the widespread practice of killing captured males but keeping the women as slaves and concubines. Or again, we may refer to the speculations concerning the entry of the soul into the embryo. With the rise of Christianity, these became of practical importance. Since according to canon law the embryo has a soul from the fortieth day onwards, the embryo that dies unborn is condemned to damnation if it be not baptised; and this led to occasional barbarities in cases of obstruction of birth. More important, it led to the view that abortion was murder, a view duly reflected in a change in practice and in law. Both the Greeks and the Romans had taken a lenient view of abortion, or like Plato and Lysis had actually defended it; but from the fourth century A.D. onwards it became both a sin and a crime. It will be of great interest to see what effect modern discoveries concerning the nature of fertilisation and the facts of early development will have on the theological and moral attitude to the problem. Already in the eighteenth century we saw Sterne pushing logic to its conclusion with his proposal for spermatozoan baptism; and now that, with the progress of endocrine research, we are likely to wake up any morning to the discovery of a physiological method of preventing implantation, or of dislodging the early embryo from the uterine mucosa before it has established its

vascular nutritive system, we may speculate whether some subtle distinction may not be drawn between an embryo and a mere blastocyst, between criminal abortion and permissible denidation. There is much virtue in terminology.

Dr. Needham is fully alive to the implications of the Marxian view as to the conditioning of scientific advance by economic conditions, and makes some valuable comments on the bearing of the social and economic status of the medical man and the midwife upon the advance of embryology. One of his most interesting sections is devoted to a discussion of the various 'limiting factors' affecting steady scientific advance. Among these he distinguishes the relation of the scientific worker to his environment, both the economic environment and the environment of idea; the degree of co-operation among investigators and scholars, including the provision of facilities for publication; material technique, such as fixing reagents, the microscope and the microtome; mental technique in the shape of convenient terminology, fruitful concepts and general attitude; and finally the proper balance between speculation, observation and experiment. As he says, "We may thus regard the progress of knowledge . . . as governed by a reaction-chain, one link of which may at any given time be slower than all the others, and hence may set the speed for the whole".

Of course, Dr. Needham's book is not mainly concerned with such general ideas. They emerge in relation to the historical facts. These are set forth in detail, in many cases with a new emphasis, and often with the inclusion of new or little-known material. But, although they constitute the backbone of the book, within the limits of a review we cannot touch on them.

To tell such a story adequately needs biological and historical knowledge, familiarity with the basic problems confronting embryology to-day as well as a sympathetic insight into those that confronted it at different periods in the past, industry, miscellaneous learning, and a philosophic spirit. Dr. Needham is one of the few biologists to possess these varied qualifications, and the result is a valuable contribution to the subject.

Naturally, there are a few points for criticism. Many who are impressed by the plasticity of the regulatory phase of development and by the modifiability of the embryo through environment will quarrel with the description of modern embryology as 'predetermined epigenesis'. To the author's citations on p. 292 concerning the dangers of too firmly-held speculation, he might have added the obstinate resistance of the phylogenetic embryologists in general and the full-blooded believers in recapitulation theory in particular to the advance of *Entwicklungsmechanik*. He is scarcely fair (pp. 40–41) to the very real and deep difference between the true teleology which appeals to final causes and the pseudo-teleology which is the necessary outcome of accepting natural selection as a *vera causa* in evolution.

At the close of his volume Dr. Needham appears unduly gloomy. "Experimental embryology," he writes, "Morphological embryology, Physiological embryology, and Chemical embryology form to-day a vast range of factual knowledge, without one single unifying hypothesis. . . ." Here we cannot follow him. On the morphological side, the broad ideas of comparative phylogeny still hold, the principle of recapitulation, however shorn of its formal absolutism, still yields indispensable service. On the chemical side, Dr. Needham himself has demonstrated the adaptational and phylogenetic meaning of certain large bodies of fact, for example the biological meaning of the numerous facts centring round the cleidoic egg. Elaborate developmental processes like amphibian metamorphosis are proving amenable to a physiological explanation. It is being shown that mutation is affected by differentiation; the expression of genes, such as that of Himalayan coat colour in rabbits, has been explained in terms of position and physiology; and the concept of rate of action, both for the effects of individual genes, for the co-ordination of complex processes of differentiation and for growth, is proving exceedingly fruitful in the hands of Goldschmidt, Ford, Witschi and others. In experimental embryology, the distinction between the plastic and the determinate phase and the realisation that the time of onset of the latter can be shifted, has broken down the old distinction between 'regulation' and 'mosaic' eggs, and established a comprehensive unity. The mathematical formulation of growth, both absolute and relative, is becoming serviceable. The earlier speculations of Child are being reshaped by Weiss and Waddington into a serviceable field theory. The work on organisers (to which again our author has made his distinctive contribution) is linking up certain important facts of embryology with the general theory of hormones.

Many of the principles that are emerging are still themselves, it is true, somewhat embryonic: but they exist, and will develop. We cannot expect, in such a complex subject as embryology, to find a single all-comprehensive unifying principle, any more than we expect it in physiology or biochemistry. Dr. Needham has promised us a sequel to the present volume, to cover the nineteenth century and modern periods of embryology. It will be eagerly awaited: but it is to be hoped that he will recover his theoretical optimism before undertaking it. J. S. H.

Science and Citizenship

The Frustration of Science. By Sir Daniel Hall, J. G. Crowther, J. D. Bernal, Prof. V. H. Mottram, Dr. Enid Charles, Dr. P. A. Gorer, Prof. P. M. S. Blackett. Foreword by Dr. Frederick Soddy. Pp. 144. (London: George Allen and Unwin, Ltd., 1935.) 3*s.* 6*d.* net.

AMONG the more hopeful signs in the last two years is the growing sense of social responsibility among individual men of science, and the widespread impatience with sabotage of foodstuffs or other products in a world in which hundreds of thousands are still insufficiently nourished or clothed. Naturally enough, both scientific workers awakened to a sense of social responsibility, and the ordinary citizen indignant at so much poverty and distress in the face of the incredible abundance with which science has endowed mankind, have been more concerned to find ways and means of appropriate action than to pause to establish the fundamental causes of this startling but distressing paradox. If, however, we are to make constructive suggestions and evolve a wise policy rather than adopt temporary expedients or palliatives, it is essential that diligent inquiry should be made into the underlying causes of what has rightly been termed the frustration of science.

The bitter charge that science has enthroned the wastrel holds too much painful truth to be ignored. Common prudence warns us of the dangers of continuing to place more and more power in the hands of those intellectually and morally incapable of using it wisely. Even if men of science as a whole have been much too prone to adopt an attitude of indifference to social questions or even to regard original thought on these matters as socially dangerous and professionally reprehensible, not even the most cynical could charge the scientific worker with the deliberate prostitution of his discoveries and inventions to the infliction of suffering, the multiplication of unemployment, or of the risks and horrors of war.

The essays which appear in this volume, following a foreword by Prof. F. Soddy, demonstrate most effectively how impossible it is for the scientific worker to remain indifferent either to the social and economic consequences of his work, or to those forces which determine even the direction which his work shall take.

Inevitably some provocative matter is to be found in a book of this type, but its arguments are the more impressive because no claim is advanced for exceptional powers for scientific workers as a class, as compared, for example, with politicians. On the contrary, the tendency to place all the blame on the politician is vigorously attacked. The book pleads not so much for the participation of the scientific worker in the actual task of government on such lines as those outlined by Prof. Miles Walker in a well-known address, or even of the contribution of a detached, scientific attitude to political questions, as for the body of scientific workers to throw in their lot with one or other of the main contending forces.

This contention will no doubt disappoint many who believe that the study of difficult political, social and economic questions by the scientific method is a most fruitful line of advance. Such scientific workers will, however, find a good deal of food for thought in the frank disclosure of forces which at present prevent any such attitude of mind or attack on these questions. The problem as visualised by this book is that of securing the conditions in which a scientific approach to these questions becomes possible.

The facts marshalled in support of this thesis sometimes make bitter reading. What a bankruptcy of mind and leadership, for example, is betrayed in proposals to restrict output in face of over-production when more land, more labour, more skill are still required to supply the greater part of the population with the mixed dietary of a better-class family in place of a diet almost exclusively existing of cereals. The application of science to the distribution of the productive capacity of the world and to the government of its peoples demands a wealth of directive skill and a technique of national organisation which necessitate in effect a social revolution as well as a complete change of outlook.

Aviation tells the same story. Contrary to popular belief, technical development in war-time is slower than in peace-time, although the British expenditure was four times as great in 1914–18. Long-distance aviation has been severely frustrated by the refusal of Governments to allow air routes to be operated in the most economical and effective manner over their territories. "First over Everest" contains painful evidence of the hindrances in the way of science placed by nationalistic Governments and military needs, and J. G. Crowther asserts that aviation will remain frustrated as long as it is not conducted primarily to serve the creative classes.

Even the chapter on science and industry discourages any easy optimism that all is well here also. The waste of expenditure on war research, the inefficiency of scientific work in the universities, the general lack of direction of research even in physical science, and the loss of freedom on the part of the scientific worker, are all matters on which Mr. J. D. Bernal causes us furiously to think. Again, there is the still considerable time-gap between theoretical discoveries and their

application, the immense amount of technical knowledge still unappropriated by society or industry even for the relief of suffering, the way in which the economic structure itself opposes technical change and the adoption of new methods or standards of living, limiting alike expenditure on research and utilisation of existing knowledge.

This sombre picture of the way in which scientific development may be held up by lack of support or turned to trivial or destructive uses cannot be ignored by the man of science. He at all events should see through the fallacy of a demand for less science and a return to simpler times, when what is really needed is the application of science to the convenience of living instead of to profit-making. Nor can he fail to be alive to the danger of the degeneration of science under what is called economic nationalism, and the narrowing of its functions, or the way in which professional efficiency and a scientific outlook in the practitioner are threatened by the conditions under which he is called upon to practice, as in the medical profession to-day.

The exact relations between scientific workers and political organisations may be open to debate. There can be no question, however, as to the need for much more open-mindedness on the part of all men of science towards the social and industrial problems of their environment to-day. Even from the point of view of the advance of science itself they must face those problems. Much more must they accept the challenge, corporately and individually, if they care anything for the enrichment of mankind with the vast resources of material well-being and leisure which science has now put within our power. That era of plenty can only be achieved as men of science face frankly such problems as are presented in this book and, faithfully proclaiming the truth, strive as earnestly and disinterestedly for their solution, for the distribution of wealth and the science and art of living as in the past they have striven for the acquisition of the knowledge which places an age of plenty and of leisure within the reach of all.

R. B.

Development of High-Speed Aircraft

Air Ministry: Aeronautical Research Committee: Reports and Memoranda. No. 1575: *Collected Reports on British High Speed Aircraft for the 1931 Schneider Trophy Contest.* Pp. iii+100+60 plates. (London: H.M. Stationery Office, 1934.) 10*s.* net.

THIS monograph describes the development of the British aircraft for the Schneider Trophy contest of 1931, the preparations for and the actual contest, also the successful attempts on the speed record afterwards. It is mainly concerned with the technical aspects, although a tribute is paid to the great skill of the pilots, without which the successes could not have been achieved.

The book is divided into sections, each written by the persons mainly responsible for the work described, and although it forms a connected whole, the individual reports are self-complete.

Section 1 is an introduction by H. M. Garner, giving a brief description of the history of the 1931 contest and a summary of the contents of the monograph. In Section 2 the development of the design and construction of the *S*.6*A* and *S*.6*B* are described by R. J. Mitchell, the chief designer of Supermarine Aviation Co. (Vickers), Ltd. Although the design was based on the *S*.6, the Schneider Trophy winner of 1929, there were a number of problems which required further solution, and these were dealt with by Mr. Mitchell in co-operation with the Air Ministry and National Physical Laboratory staffs. Probably the most difficult problem was the provision of adequate water- and oil-cooling.

Section 3 describes the development of the engine by Messrs. Rolls-Royce, Ltd. Although the external shape of the 1929 engine was scarcely altered, almost the whole of the working parts of the engine had to be re-designed. The airscrews were all of the Fairey-Reed type, and a description of the development of them is given in Section 4.

Section 5, describing the wind tunnel tests, is written by the National Physical Laboratory staff. The tests were made on as large models as possible in the Duplex wind tunnel at the National Physical Laboratory in order to reduce the scale effect. For the first time in the history of these contests a large amount of full-scale data was collected. This is described in Sections 6 and 7 and also in a separate report (R. and M. 1472).

The flying experiences of the high-speed flight are summarised in Section 8, and the medical aspect of high-speed flying is discussed in Section 9.

The monograph concludes with Section 10, giving a short descriptive account of the Schneider Trophy contest and the two speed record flights. It is evident that the speed in the contest could have been improved had not instructions been given to take no risks on the turns and to keep the water temperature of the engine at a safe level by throttling. A subsequent speed record flight of 407½ m.p.h. was made.

The monograph illustrates the many aspects of aeronautical research which have to be considered in the development of racing aircraft. It should certainly be read by all aircraft designers, and in a broader sense it is an excellent example of how scientific and technical experimentation upon a specific question should be organised.

Short Notices

The Generic Names of the Holarctic Butterflies. By Francis Hemming. Vol. 1: *1758–1863.* Pp. viii+184. (London: British Museum (Natural History), 1934.) n.p.

THIS book aims at providing a list of generic names proposed for the holarctic butterflies between the years 1758 and 1863, inclusive. It also attempts to give the correct fixation in so far as typical species, or genotypes, are concerned. Mr. Hemming has based his results and conclusions on an exhaustive first-hand examination of the whole of the literature concerned. Entomological workers have long been hampered by doubts obtaining relative to the correct names of so many of the insects they study. Among these uncertainties, generic names are paramount, while specific names are of lesser importance and would prove of little difficulty once uniformity of generic nomenclature could be attained.

With few exceptions, the strict application of the present International Code of Nomenclature has been followed; in certain instances—widely used names, especially those of insects of economic importance—the strict application of such rules would result in unnecessary confusion. It is, therefore, suggested that with regard to seven well-known genera, the application of the rules be suspended and that such names be placed in the list of *nomina conservanda*. In the appendix at the end, the relevant articles of the nomenclature code that have been followed are given and are thus available for ready reference. It is to be hoped that the International Commission of Zoological Nomenclature will, as soon as may be possible, exercise its plenary powers and decide in favour of the recommendations put forward. Mr. Hemming has evidently carried out his task with great care, and the result of his labours will be welcomed by lepidopterists of both Europe and North America.

Ancient Egyptian Materials and Industries. By A. Lucas. Second edition, revised. Pp. xii+447. (London: Edward Arnold and Co., 1934.) 16*s.* net.

IN this volume the author has published with a change of title a second edition of his "Ancient Egyptian Materials" (1926). Those who are acquainted with the book in its earlier form will scarcely need assurance of the merits of the revised edition. The author has incorporated much fresh material, which has accrued from his further researches. Three chapters have been added as the result of much expansion and rearrangement; and the ancient industries, which received little more than mention, have now been treated in some detail. Among the industries with which Mr. Lucas deals are faience- and glass-making, metal-working, pottery-making and stone-working, while among the new materials added are coral, cosmetics, perfumes and mother-of-pearl. Many additions have been made to the references from the Greek and Latin writers, and the chemical analyses, now much expanded, again appear as an appendix.

Electrolytes. By Prof. Hans Falkenhagen. Translated by R. P. Bell. (International Series of Monographs on Physics.) Pp. xvi+348. (Oxford: Clarendon Press; London: Oxford University Press, 1934.) 25*s.* net.

DESPITE the existence of some excellent English works on the subject, this translation of Prof. Falkenhagen's treatise is a very opportune addition to physical literature. The book is thoroughly physical in its outlook, and the mathematics employed serves to clarify and to emphasise the physical concepts.

A notice of the work would become a mere catalogue if it attempted to give the reader an adequate notion of the topics dealt with; suffice it to say that the book begins with Faraday, and, after discussing ideal dilute solutions and weak electrolytes, proceeds by way of Lewis's theory of activities to a study of those theories involving interionic actions which have, during recent years, dominated the subject.

It is sufficient commentary on the rapidity with which the subject is developing to note that this volume—a translation of the German edition of 1932—has been brought up to date by the addition of sections dealing with recent extensions of Bjerrum's theory, with Onsager's treatment of the dissociation field effect, and with applications of quantum mechanics to electrode processes.

Scholarly and very fully-documented, the book is indispensable to any serious student of electrolytic phenomena. A. F.

Palestine and Israel: Historical Notes. By Sir Flinders Petrie. Pp. 99+16 plates. (London: Society for Promoting Christian Knowledge, 1934.) 3*s.* 6*d.* net.

SIR FLINDERS PETRIE here describes in popular form the contacts between archæology and scriptural narrative of early Israelitish history, mainly in the results of the excavations of the British School of Archæology in Egypt in Southern Palestine. The cardinal point of his argument, however, is the consistent character of the patriarchal narrative, when the years of the Biblical account have been subjected to amendment on lines for which there is strong grounds of probability. The later dating of the Exodus is then shown to fall into place.

The treatment of the Biblical text throughout is essentially conservative. The author holds that the results of textual criticism are largely irrelevant. The narrative is not a jumble of sources little better than fortuitous, but, he maintains, can be shown to be a carefully considered selection from a variety of sources in the construction of a complicated, but consistent, story.

WE regret that in referring to "The Kinetic Theory of Gases", by Prof. Leonard B. Loeb, in NATURE of March 9 (p. 390), the publisher's name was incorrectly given as Messrs. Chapman and Hall, Ltd. The book is published by The McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London, W.C.2.

The Uses of Rubber

By G. E. COOMBS

THE rubber industry of to-day is concerned almost exclusively with the exudation which results from wounding certain of the tissues of *Hevea brasiliensis*, a large tree 80–100 ft. tall which is indigenous to the Amazon basin. The tree will grow almost anywhere in the belt 10° north and south of the equator, though it does not compete economically at elevations above 2,000 ft. Its translation from the Amazonian forests to plantations in the tropical Middle East is a romantic story associated with the names of Markham and Wickham.

The development of these plantations has been very rapid, the area having increased by fifteen times in the past twenty years, until to-day the production side of the industry is concerned with 7–8 million acres of plantations, chiefly in British Malaya, Netherlands Indies, Ceylon and French Indo-China, capable of producing more than a million tons of the product annually. This enormous aggregate area carries the progenies of the seeds collected by Wickham (1876) from the Amazon basin.

The exudation referred to above is known as hevea-latex, since *Hevea brasiliensis* is only one of some four hundred plant species which elaborate juices containing rubber or rubber-like substances. It is generally ivory white in colour, and tends towards the consistency of cream. It has practically the same density as water, and an average sample contains 35 per cent of rubber as a colloidal suspension of tiny globules which are negatively charged. Rubber itself is an unsaturated hydrocarbon with an empirical formula $(C_5H_8)_n$, where n possibly approximates to 1000. The suspension is very unstable, and if left to itself it develops acidity, when its globules coalesce to produce a coherent junket-like coagulum. Once the latex is coagulated it is not possible to reverse the process and recreate the suspension. The coagulation can be speeded up and be made complete by, for example, the addition of dilute acetic acid. It can also be prevented by the addition of ammonia, whereby the latex is kept 'sweet' and stable. In such condition it can be concentrated by creaming or centrifuging; further, with the addition of protective colloids, for example, soaps, glue, casein, etc., it can be concentrated by evaporation.

Very little is known of the biochemical processes which lead to the formation of latex in the tree, or of the rôle it plays in its life-processes. It occurs, and is probably elaborated, in a definite system of branching tubes, associated with the vascular tissue of the tree, which finds its highest development and greatest density in the inner bark of the base of the trunk, whence it is procured by 'tapping'. Speaking generally, the raw rubber of commerce is merely the dried coagulum of hevea-latex, and except for the preparation of preserved latex, an operation confined as yet to a few estates, the producing side of the industry finishes with the shipment of the dried product. This product is of limited utility. Among other things it becomes tacky with heat, stiffens with cold, and perishes with age. Early attempts to use it entailed its reconversion to liquid form by the use of solvents (Peal 1791 and Mackintosh 1819).

The rubber manufacturing industry of to-day was made possible by two empirical discoveries. Hancock (1820), seeking to shred the material on spiked rollers, discovered that the operation produced a plastic mass which could be moulded to shape. This process of mastication remains to-day as the preliminary in practically all manufacturing operations. We now know that oxidation and the generation of heat are the factors responsible. When, however, Goodyear (1839) and Hancock (1842) discovered independently that raw rubber subjected to heat in the presence of sulphur produced a much toughened product, relatively insensitive to temperature changes, and possessing a large number of other desirable properties, the foundations of the industry were laid. The reaction is known as vulcanisation. The chemistry and physics involved in it are obscure. These two discoveries made possible the transformation of raw rubber into a plastic mass, the incorporation of softeners to ease manipulation, of reinforcing ingredients, of anti-oxidants which preserve its properties, of inert materials which cheapen its products, and of accelerators which speed up the vulcanising process.

The science and art of the technologist enable us to-day to produce materials presenting wide ranges of colour, density, elasticity and resilience, specific electrical resistance and resistance to abrasion; products can be made which are impermeable to liquids and gases and resistant to corrosive chemicals. There are endless combinations of desirable qualities which can be brought together to serve specific purposes. In a survey of the latter, however, it is necessary to distinguish between the following: latex, rubber solutions, soft vulcanised products and hard vulcanised products; all these represent different physico-chemical forms of rubber.

Latex is comparatively new in industrial applications, and one of the most important discoveries

in connexion with it is that the rubber can be vulcanised in its natural 'aqueous' form. It is rapidly replacing solutions of raw rubber in coal-tar naphthas, in the treatment of tyre fabrics, in spread- and dipped-goods. It is of special value in the manufacture of sponge rubbers and electrically deposited rubbers, and—looking to the future—its use as a binder, either as a main or auxiliary material, bids fair to penetrate far and wide in industry.

The common solvent for raw rubber is coal-tar naphtha. Solubility is increased by previous mastication of the rubber, though this treatment decreases subsequent adhesive properties. Uses here lie chiefly in the field of adhesives and fabric proofing.

If the process of vulcanisation is carried out in the presence of excess sulphur, vulcanite or ebonite (hard vulcanised rubber) is produced. The two main fields of application are electrical insulation and corrosive resistant goods, such as linings for conveyors, storage tanks and pipes.

There remain the soft-vulcanised products, and it is in this category that rubber displays its amazing versatility. Its applications are literally too numerous to mention.

A rough index of proportionate industrial absorption of rubber based on American data is approximately: automobile industry 80 per cent, footwear industry 9 per cent, electrical industry 1 per cent, fabrics 1 per cent, surgical goods 0·5 per cent and the balance in toys and novelties, floorings, etc.

Of the fundamental problems concerned with the constitution of the rubber hydrocarbon molecule, the process of vulcanisation, now almost a century old, the action of accelerators and the colloidal system presented by rubber-latex, relatively little is known, and it is surprising that the technologist has been able to advance so far without more aid from fundamental research. That his advance has been substantial is a matter of universal experience, but he who would make his experience more intimate and widen his knowledge of a young industry with great potentialities, will find profit in a visit to the Rubber Exhibition at the Science Museum, South Kensington.

This exhibition is a very comprehensive one, and its sponsors have met with a full measure of success in their efforts to make it educative. A wide field is covered from the planting of the *Hevea* seed. The exploitation of the bark, the processing of latex to produce plantation grades of raw rubber, the milling and compounding of the latter to produce articles of everyday use, are shown. It is not possible to deal more than briefly with the general sections of the exhibits.

The plantation section shows the lay-out of an estate and the work involved in good husbandry, the prevention of soil erosion, measures of prophylaxis against disease, the economic tapping systems and the operations involved in re-stocking, by the propagation of pedigree buddings. An exhibit of particular interest to the layman is the display of latex, since, while it was recorded as long ago as 1781 that this material could be preserved by the addition of certain alkalis, it was not until 1920, when bulk shipments were sent in the ballast tanks of steamers from Sumatra to America, that it became important industrially. How important it is now will be evident when the visitor sees rubber-thread, sponge rubber and dipped goods made from it.

The manufacturing section, besides showing the latex applications, shows the machinery for milling, compounding and vulcanising in actual operation.

The scientific section is of special merit in demonstrating the varied contributions of science to the development of the industry. Demonstrations are staged showing the Brownian motion of the latex globule and its movements in an electrical field, the technique involved in dissecting the rubber globule, operations of creaming, centrifuging, homogenising and coagulating. The student technologist can revel in plastometers, viscometers, durometers, etc. He will be attracted by an ingenious device demonstrating the relative activity of various accelerators. He will be able to inspect a Wiegand's pendulum and demonstrate to himself the Joule effect. He should take this unique opportunity to inspect a well-arranged, though congested, set of valuable instruments and apparatus.

The section dealing with applications ranges from the service of the product in the automobile industry to almost the complete fitments of a surgical theatre.

The historical section contains the original plaster study of the bust of Sir Henry Wickham, seeds of the original collection made by him in the Amazon basin, and such interesting exhibits as Hancock's experimental machinery.

There is one inconspicuous exhibit of special interest to the research worker. This contains expanded chlorinated rubbers, oxidation products of rubber, and a variety of new products which touch the fringe of what must be a field of great possibility, namely, the use of rubber as a raw commodity for the manufacture of other substances. In this connexion, we have recently learned that rubber is amenable to hydrogenation.

Exhibitions of this nature are very difficult to organise, and the best-organised of them can be prodigal of a visitor's time. To minimise this, the sponsors have made available a carefully indexed guide. This reaches a high standard and the visitor will find it very informative and almost indispensable.

International Union of Pure and Applied Physics

REPORT OF THE COMMISSION OF SYMBOLS, UNITS AND NOMENCLATURE

IN 1931, the International Union of Pure and Applied Physics appointed a commission consisting of Profs. Keesom, Kennelly and Fabry under the chairmanship of Sir Richard Glazebrook, with Dr. Ezer Griffiths as secretary, to deal with the general questions of symbols, units and nomenclature. This Commission submitted its report to the General Assembly of the Union at its meeting in London on October 5 last, and the following resolutions were authorised for publication.

THE STANDARD THERMAL UNIT

(1) The unit of heat when measured in units of energy shall be the Joule, defined as equivalent to 10^7 ergs.

(2) The gram-calorie is the amount of heat required to raise the temperature of one gram of water from 14·5° to 15·5° of the International Scale of Temperature under normal atmospheric pressure.

As a note on recommendation (2), it is stated that according to existing measurements, the gram-calorie is equivalent to $4{\cdot}18_6$ Joules, and that pending a decision by the International Convention of Weights and Measures as to the relation between the International and the C.G.S. electrical units, the value of the International Watt Second may be taken as 1·0003 Joules.

ELECTRICAL AND MAGNETIC UNITS

The accompanying table was accepted as defining the units in terms of which the electromagnetic quantities required for practical purposes are measured.

TABLE 1. ELECTROMAGNETIC UNITS

Quantity designated	C.G.S. units			Practical units in terms of	
	Symbol	Defining equation	Name	C.G.S. units	Volt-ampere units
Flux	Φ	$\frac{d\Phi}{dt} = -E$	Maxwell	10^8 Maxwells	Volt second
Magnetic Induction or Flux Density	B	$\int B\,dS = \Phi$	Gauss	10^8 Gauss	Volt second per cm.^{2}
Magnetomotive Force round a circuit	F	$F = 4\pi NI$	Gilbert = Oersted cm.	10^{-1} Gilbert	$1/4\pi$ ampere-turn
Intensity of Magnetising Field	H	$\int H \cos\varepsilon\, dl = F = 4\pi NI$	Oersted	10^{-1} Oersted	$1/4\pi$ ampere-turn per cm. of path of H
Permeability	μ	$\mu = \frac{B}{H}$	Permeability*	$\frac{10^8 \text{ Gauss}}{10^{-1} \text{ Oersted}}$	$\frac{\text{Volt second per cm.}^2}{1/4\pi \text{ ampere-turn per cm. length of path of } H}$

* The unit of 'permeability' on the C.G.S. system is the permeability of free space—in practice that of the air. This unit has received no special name. The statement that the permeability of a given medium is μ implies that it is μ times the permeability of free space.

Complete agreement as to the definitions of B and H has not yet been reached. For the definition of B we are not far from it, but the definition of H still remains somewhat uncertain. If in the future, definitions should be adopted which would imply that B and H are quantities of the same kind, Table 1 would still hold. It would then be understood that the names Gauss and Oersted were two different names given to the same quantity determined by experiment. In these circumstances either one or the other of the two synonymous words might be employed as found more convenient.

In the report mention is made of the decisions of the International Electrotechnical Commission at its meeting in Paris in 1933, one of which was the statement that the formula $B = \mu_0 H$ represents the modern concepts of the physical relations for magnetic conditions *in vacuo*, it being understood that in this expression μ_0, the permeability of free space, possesses physical dimensions.

In the case of magnetic substances, the above formula becomes $B = \mu_1 H$, in which μ_1 has the same dimensions as μ_0. It follows that the specific or relative permeability of a magnetic substance is a number equal to μ_1/μ_0.

As a consequence of this, the International Electrical Commission recommended that the symbol μ_0 should be introduced into certain formulæ employing magnetic units.

The report also includes a number of appendixes dealing with the basic definitions of the system of electrical units; alternative methods of definition; the resolutions adopted by the International Electrical Commission at Oslo in 1930; and the Giorgi system, in which the metre and the kilogram replace the centimetre and the gram in the system of fundamental units, whilst the ohm is taken as the fourth. There is also a supplement by Prof. Abraham entitled "Note sur ce que pourraient être les définitions des grandeurs magnétiques", which has been prepared by him in response to a request made at a meeting in Paris in July 1932.

THERMODYNAMIC SYMBOLS

The Commission in its report points out the diversity of practice as regards thermodynamic symbols, and is of the opinion that it is desirable to make an effort to remedy the existing confusion.

The following resolutions were accepted by the General Assembly.

(1) That Table II be put forward for the National Committees as a satisfactory series of symbols and nomenclature for the thermodynamic quantities referred to, and

(2) That E, φ and I be accepted as alterna-

tive symbols for Internal Energy, Entropy and Heat Content respectively.

(3) That thermodynamic quantities should always be expressed in the Centigrade scale of temperature.

TABLE II. SYMBOLS FOR THERMODYNAMIC QUANTITIES

Name	Entropy	Internal Energy	Free Energy	Thermal Potential or Gibbs' Function	Heat Content or Enthalpy	Work
Formula	—	—	$U - TS$	$U - TS + PV$	$U + PV$	
Symbol	S or φ	U or E	F	G	H or I	W

In the above formulæ, P and V should be interpreted as representing a generalised force and generalised co-ordinate respectively.

FUTURE WORK OF THE COMMISSION

Consideration was given to the policy which should govern the future activities of the Commission and its relationship to those other international bodies which deal, among other matters, with the definitions and nomenclature of their subjects.

The International Union of Pure and Applied Physics decided that the S.U.N. Commission might usefully continue to work:

(1) By co-operating with existing international bodies in the preparation of glossaries or lists of definitions with the view of making them more useful to physicists in general.

(2) By preparing, for general adoption, lists of terms occurring in two or more branches of physics.

(3) By assisting those who, in any country, are engaged in preparing such lists, with the view of bringing workers in different countries into contact and securing harmony in the results of their work.

Copies of the complete report of the Commission will be obtainable from the Physical Society (1 Lowther Gardens, London, S.W.7) at a price of 2*s*. 9*d*. in paper covers and 5*s*. bound in cloth.

E. G.

The Eider Duck (*Somateria mollissima mollissima*)

By SETON GORDON

THE eider duck, because of the handsome and striking plumage of the drake, is a familiar object off the coasts of Britain. It is more numerous in Scottish than in English waters, but is plentiful throughout the year off the coast of Northumbria, where the eider is known as St. Cuthbert's duck, because of the tradition in the district that St. Cuthbert, who had his cell on one of the Farne Islands, tamed the eiders of old.

In Scotland the eider duck is found both east and west, and is particularly numerous during the winter months on the sheltered sea lochs on the east side of the Isle of Skye. On the open waters of the Minch it is not really plentiful, nor is it often seen in winter on the open Atlantic west of the Hebrides. When the eider is seen at close quarters the striking beauty of both drake and duck is apparent. The drake with his black head, pale sea-green cheeks, and white breast with its faint rosy flush, is a striking object as he courts his more sober-coloured mate, but she, too, is beautiful, for a warm rosy flush is upon the rich brown feathers of her breast and back, and to relieve the monotony of her colouring there are two white bars on her wings.

The late Viscount Grey of Fallodon had an eider drake in his bird sanctuary at Fallodon for twenty-one years, and up to the last the old eider, although he was blind in one eye, delighted in courting the mallard ducks on the pond, and their rightful mates, aware that the old fellow's intentions were harmless, watched him with amused tolerance.

In very early spring, sometimes even in winter, the eider drake can be seen courting the duck that has attracted his fancy. Swimming round her, he raises himself on the water and utters soft cooing notes. It is indeed possible that the eider remains paired throughout the year, and the late Viscount Grey told me that on seeing a large flock of eiders off the coast of Northumberland one winter day he carefully counted the sexes in the flock, and found that ducks and drakes were present in exactly equal numbers.

It is a characteristic of drakes which have an 'eclipse' plumage that they take no part in the rearing of the brood, and the British eider drake is never seen near the nest. In this characteristic he is different from the eider of Spitsbergen, which nests in colonies. I visited some of these Spitsbergen colonies in the summer of 1921, and found the drakes on the island with the ducks, and in some instances standing guard while the ducks brooded their eggs. The drakes may have kept off the Arctic skuas which were present at most of these colonies of eiders, ready to swoop down and suck the eggs of any unprotected nest. Sometimes when an eider duck left her nest, after having covered it carefully with the down which lined it, she apparently thought that her eggs would be safe from the marauding skua gulls, but the skua

on flying up, with a few swift and deft movements of the bill, exposed the eggs and made a rapid meal of them.

Sealing sloops make the journey each summer from northern Norway to Spitsbergen to gather eggs and down of the eider duck. The down is used for quilts, and the eggs are sold in the northern towns and villages of Norway, where the domestic hen (perhaps because of the difficulty of feeding it through the long Arctic winter) is rarely seen.

The eider duck is an assiduous diver, and most of its food is taken from the floor of the ocean. It is particularly fond of mussels, and the fishermen of the north-east coast have tamed eider ducks in a remarkable manner by feeding them on the mussel bait that is wasted when a sudden change of weather with rough seas, occurring after the mussels have been shelled, prevents the lines being baited with them. The eider duck feeds also upon limpets, periwinkles and razor-shells, and has been known to swallow razor-shells up to ten inches long. Small crabs, sea-urchins and star-fish are also eaten. Eider ducks are expert divers, but they do not like a rough sea, and are not happy in turbulent breaking waves where scoter and scaup are often seen swimming and diving. Eiders, both ducks and drakes, often land on some low skerry on a falling tide, and stand contentedly, dozing or preening their feathers, but the eider duck very rarely ventures above high tide-mark except during the nesting season.

I do not remember having seen an eider drake at any distance from the tide except on one occasion. This was early on a May morning, in the Isle of Skye. I was motoring along the main road between Portree and Kyleakin, and where the road skirts Loch Ainort and winds along the hill-face at a height of perhaps one hundred feet above the sea, I saw on the road what at a distance I thought was a seagull. But as I approached I saw that this was no gull, but an eider drake, and as the car neared him he flew out over the heather-covered hillside and then out over the sea. He may have been accompanying his duck in a search for a suitable nesting place, but if the duck was in the neighbourhood she did not appear, nor did she fly away with the drake.

The eider lays four to six large unspotted eggs of a greenish colour, and when she is suddenly disturbed from them she fouls her nest as she flies off, presumably to render the eggs less attractive for an animal which might otherwise make a meal off them. The ducklings take to the sea on the day they are hatched, and are able to swim and dive actively. They are excellent divers even from their earliest youth, and are able to survive and even to enjoy breaking waves, diving through them and keeping pace with the mother without difficulty. But a prolonged period of rough and cold weather soon after they are hatched is fatal to the weaker members of the broods, and a mother eider duck may often be seen with only a single duckling following her. The young ducklings have many enemies, and perhaps the most ferocious is the greater black-backed gull, which pounces down upon an unattended duckling and swallows it whole.

Obituary

PROF. CHRISTIAN HÜLSEN

WE regret to record the death of Prof. Christian Hülsen, the archæologist, which took place at Florence on January 19 at the age of seventy-six years.

Christian Hülsen was born at Charlottenburg and was educated at the University of Berlin, where he came under the influence of Theodor Mommsen, the Roman historian. From 1882 until 1885 he studied in Italy as a travelling scholar of the Archæological Institute. He returned to Berlin as a schoolmaster, but in 1887 he became a secretary of the German Archæological Institute in Rome, where he remained until his retirement in 1909. He then took up his residence in Florence and devoted the remainder of his life to writing and research.

Hülsen's main life-work as an archæologist lay in the two departments of epigraphy and topography. As an authority on the Rome of the classical, medieval and Renaissance periods he was without a rival, with the exception of the late Prof. Lanciani. His book on the Forum and its excavation by the Com. Boni achieved a wide popularity, while for more serious students his account of the excavations on that site and on the Palatine, published in 1928, is a standard of reference. Of an even more authoritative character is his "Formæ Urbis Romæ antiquæ", which is especially of value to the student for its plans of the ancient city, and its index and bibliography of the monuments. In the study of medieval and Renaissance Rome, his outstanding contributions were the publication of the Barberini codex of Giuliano de Sangallo and of the Berlin drawings of Marten van Heemskerch, the latter in collaboration with Hermann Egger. His "The Churches of Rome in the Middle Ages" is a mine of valuable detailed information.

In epigraphy Hülsen's immense fund of knowledge of Roman topography served him well in compiling the inscriptions of the city of Rome for the "Corpus Inscriptionum Latinarum". In addition to his other work which appeared in book-form, he was the author of a large number of contributions to archæological periodical publications in both Italian and German.

Hülsen was an honorary D.Litt. of the University of Oxford and of Columbia University, New York, where he had delivered a course of lectures. In 1917 he was appointed honorary professor in the University of Heidelberg, and shortly before his death he was informed of his election to be one of the nine honorary members of the Pontifical Academy of Arts and Archæology, Rome.

Mr. John Fraser

John Fraser was born on January 31, 1854, at Newdeen, Fraserburgh, Aberdeenshire, and died in Charing Cross Hospital on January 24, 1935, from pneumonia following injuries received in a road accident.

Mr. Fraser was well known both as a horticulturist of high repute and as a critical student of the British flora. In horticulture he received training at the old Chiswick gardens of the Royal Horticultural Society and at Kew. In May 1885 he commenced work in the Jodrell Laboratory, Kew, for Sir John Lubbock, afterwards Lord Avebury, and the connexion thus established lasted for many years. Fraser was responsible for much of the detailed work underlying Lord Avebury's classical researches on seedlings, pollen, buds, stipules and other botanical subjects. He also edited or contributed to many well-known horticultural publications.

As a field collector and observer and a herbarium investigator, Fraser was held in high esteem by a wide circle of botanical friends. In his later years he specialised on the taxonomically difficult genera *Mentha* and *Salix*, and his published accounts of these genera give evidence of a clear logical mind and considerable ability in concise description. His fine herbarium collections of about nine thousand sheets, together with his manuscript notebooks, have been presented, at his written desire, to the Royal Botanic Gardens, Kew, by members of his family. There are many valuable Scottish gatherings among his specimens, and the flora of Surrey is particularly well represented. His collection of seedlings of British plants, numbering several hundred sheets, must be unique, and will be of great value in future investigations of life-histories.

Fraser was elected a fellow of the Linnean Society in 1889, and the Council of the Royal Horticultural Society conferred on him the Victoria Medal of Horticulture in 1922 and the Veitch Memorial Medal in 1929.

W. B. Turrill.

We regret to announce the following deaths :

Mr. Eric H. S. Bruce, editor of the *Aeronautical Journal* in 1899–1908, well known for his work in aviation, especially on balloons, kites and airships, on February 28, aged eighty years.

Prof. William Duane, professor of biophysics in Harvard University since 1917, an authority on radio-activity and X-rays and their application to the treatment of disease, aged sixty-three years.

Mr. W. J. A. Grant, a member of several Arctic expeditions, after whom Cape Grant in Alexandra Land was named, on March 10, aged eighty-three years.

News and Views

A British Magnetic Survey Vessel

The explanatory statement by the First Lord of the Admiralty, which was presented with the Navy Estimates for 1935 to the House of Commons on March 6, contained the interesting information that it has been decided to construct a magnetic survey vessel. A first instalment of £10,023 towards the construction of this vessel has been included in this year's estimates. The unfortunate destruction by explosion and fire of the *Carnegie* on November 29, 1929, while in harbour at Apia, Western Samoa, brought the valuable work which had been carried on by this vessel to a sudden conclusion. Constructed for, and maintained by, the Carnegie Institution of Washington, she had in six cruises between 1909 and 1921 traversed 252,702 nautical miles in 3,267 days actually at sea. Of the seventh cruise of 110,000 nautical miles, nearly one half had been completed upon the arrival of the *Carnegie* at Apia ; this cruise was planned particularly with the view of determining magnetic secular variation.

The magnetic charts published by the British and other Governments for use at sea have been based in recent years to an increasingly large extent upon the data provided by the *Carnegie*. There are some serious gaps in the present data, which would have been filled if the *Carnegie* had completed her last cruise. Due partly to these gaps and to a recent rapid change in the secular variation in the Indian Ocean, the extrapolated values of the magnetic elements in the southern Indian Ocean are now unreliable, and the possibility of serious errors in this and other areas in future charts has given rise to some concern. The Carnegie Institution, having definitely decided not to replace the *Carnegie*, and in view of the special interest of Great Britain, as the principal maritime nation, in the accuracy of the magnetic charts, the British Government has assumed the responsibility. A non-magnetic ship is to be constructed, primarily for the purpose of determining magnetic data at sea. Details of the design have not yet been decided upon, though it is probable that the new vessel will be larger than the *Carnegie*.

Refugee Scholars

A pamphlet entitled "A Crisis in the University World" issued last week by the High Commissioner for Refugees from Germany (obtainable free of charge from the General Secretary, Academic Assistance Council, Rooms of the Royal Society, Burlington House, W.1) gives an account of the assistance to displaced German scholars and men of science during the past two years. Approximately 650 of the

university teachers dismissed have left Germany. Of these, 248 have been permanently re-established, 131 in Europe and 117 outside Europe ; 366 others have been given temporary assistance which has enabled them to continue their studies in universities or other institutions. Most of this work of academic assistance has been carried out by special emergency committees in Europe and the United States, which have succeeded in raising a quarter of a million pounds for the purpose of creating special positions in universities and research centres for the refugee scholars. Nearly £69,000 has been specially raised in Great Britain for the assistance of the refugee scholars. 40 have been permanently re-established and 170 have been given temporary hospitality. In addition, the Academic Assistance Council has been recognised as the international information centre by the High Commission for Refugees. The pamphlet outlines the plans of the academic committees for the future ; it states that a constructive solution of the problem is possible and that the task undertaken by the committees is manageable, provided that there is sufficient financial support.

Academic Assistance Council

A PUBLIC appeal for funds has been made by the Academic Assistance Council to enable it to continue its work. The appeal is signed by Mr. Stanley Baldwin, Viscount Cecil of Chelwood, Mr. Winston Churchill, the Earl of Crawford and Balcarres, the Marquess of Crewe, Viscount Halifax, the Marquess of Londonderry and Lord Meston, in their private capacities as members of the university world and not officially as chancellors of British universities. The Council needs funds with which to continue emergency grants-in-aid to approximately seventy of the displaced German scholars for a period of not more than two years, and also for the creation of twenty special research fellowships of a more permanent character. It is essential also that the Council shall be enabled to continue its important work as an information centre and its investigations throughout the world for new positions in which the temporarily assisted scholars may be placed on a self-supporting basis. The Academic Assistance Council has, from the start, emphasised the issues of principle implicit in its work ; it has not confined its activities to the displaced German scholars alone. The great importance of the research which the Council has been able to salvage has been demonstrated from time to time during the past two years in our own columns and in those of other scientific journals. As a research subsidising organisation, the Council has, indeed, an impressive record and merits continued support. Donations, subscriptions or bequests should be sent to Lord Rutherford, president, Academic Assistance Council, Rooms of the Royal Society, Burlington House, W.1 ; cheques should be made payable to the Academic Assistance Council.

Col. Crompton's Ninetieth Birthday

THE many friends of Col. R. E. B. Crompton, F.R.S., are organising a banquet to be given in his honour on May 31, which will be his ninetieth birthday. At this banquet he will be presented with his portrait, and he has signified that his intention is to present it to the Institution of Electrical Engineers. Col. Crompton has had a wonderful life. He still talks about the Great Exhibition in Hyde Park in 1851 as if it were an affair of yesterday. At the age of eleven, he enrolled as a cadet in the Royal Navy, and before reaching the age of twelve received the Crimean War medal and Sebastopol clasp. In 1864 he was gazetted into the Rifle Brigade, and did much for road transport in India by helping to substitute road engines for bullock trains. He began work as an electrical engineer in a small way at Chelmsford in 1878, but in 1881 at the Paris Exhibition he gained the first gold medal ever given for electric lighting plant. In 1886 we find him, with the warm approval of the Emperor Francis Joseph, supplying the Opera House in the Ring Street in Vienna with the electric light ; and he soon found it necessary to open a branch in Vienna. He took a leading part in the South African War, designing traction engines fitted with dynamos and portable searchlights. He also saw much active service. During the War of 1914–18 he did very valuable work in connexion with 'tanks'. He has always had an unflagging interest in motor vehicles and in the adaptation of roads for their use. Those who use our highways owe him a deep debt of gratitude. He has been a member of the councils of the Institutions of Civil and Electrical Engineers longer than anyone else.

Prof. Norbert Wiener

PROF. NORBERT WIENER, professor of mathematics at the Massachusetts Institute of Technology, has accepted an invitation to join the faculty of the National Tsing Hua University in Peiping, China, as research professor of mathematics for the next academic year. Prof. Wiener expects to sail for China next July. Dr. Wiener's outstanding contributions in the field of higher mathematics have brought him wide recognition. Last April he was elected to membership of the U.S. National Academy of Sciences, and in 1933 he was a joint recipient of the Bocher prize given by the American Mathematical Society for notable work in mathematical analysis. He is a member of the London Mathematical Society, and in 1931–32 served as lecturer at the University of Cambridge. He has carried on advanced studies at Cornell, Columbia, and the Universities of Cambridge, Göttingen and Copenhagen. He joined the staff of the Massachusetts Institute of Technology in 1919 and in 1932 was appointed to full professorship. The National Tsing Hua University is maintained by indemnity funds following the Boxer rebellion, which were returned to China for educational purposes by the United States. From time to time the University entertains men eminent in various academic fields as visiting members of its staff. Among them have been Prof. George D. Birkhoff of the mathematics department at Harvard, the Indian poet and philosopher, Rabindranath Tagore, Bertrand Russell, the French mathematician, Hadamard, and the French physicist, Langevin.

Max Oertel

MAX JOSEF OERTEL, one of the most eminent and versatile German physicians of the second half of the nineteenth century, was born at Dillingen in Bavaria on March 20, 1835. He first studied under Prof. von Pettenkofer at Munich, where he made a considerable number of analyses of the air in various public institutions and private houses which he published in a work entitled "Experiments on the Accumulation of Carbonic Acid in Inhabited Localities". Afterwards he devoted himself to the study of diseases of the throat, including diphtheria, on which he published some of the most important articles on the causation of the disease prior to the discovery of the Klebs-Loeffler bacillus. His other works on diseases of the throat were concerned with tumours of the larynx, instruction in laryngology, and treatment of respiratory affections. Oertel was the first physician in South Germany to lecture on laryngology, and was appointed extraordinary professor of laryngology at Munich in 1876, which office he held until his death on July 19, 1897. He was also well known as a general physician and particularly for his treatment of diseases of the heart, in which he paid special attention to diet and exercise.

Award of the Duddell Medal to Dr. W. E. Williams

THE council of the Physical Society has awarded the twelfth Duddell Medal to Dr. W. Ewart Williams, lecturer in physics at King's College, London, who is distinguished for his work in optical design, chiefly in the region of interferometry. The Medal is given to "persons who have contributed to the advancement of knowledge by the invention or design of scientific instruments, or by the discovery of materials used in their construction". The principal invention of Dr. Williams is that of the reflection echelon spectroscope. The basic idea of such an instrument was described by the late Prof. Michelson nearly forty years ago, but its practical construction seemed impossible until the discovery by Williams that two optically plane surfaces of quartz or fused silica could be placed in permanent optical contact without exerting the mechanical force needed with glass surfaces. He saw that a number of fused silica plates of exactly equal thickness could be built up in the necessary echelon formation without introducing any distortion that would ruin the optical performance of the instrument. The reflection echelon is the only form of spectroscope of sufficient resolving power which can be used in the ultra-violet part of the spectrum, where, in a number of cases, lie the lines of greatest interest from the point of view of 'fine structure', a detailed study of which gives us information about the structure of the nucleus in its normal state.

BY adding two small mirrors to the echelon and mounting it in an evacuated chamber, Dr. Williams has adapted the instrument, originally meant for fine-structure work only, for the accurate measurement of the wave-lengths of the lines. In consequence of the far greater resolving power now available, the wave-lengths of the lines can be measured with a corresponding greater degree of accuracy, and the method of calculation is far simpler and more rapid than with the Fabry-Perot interferometer. He has also devised a method of standardising the metre in terms of wave-lengths by means of the reflection echelon. This permits the number of wave-lengths contained in a gauge of approximately a metre length to be determined in two operations, as distinct from the numerous stages involved in the present methods. The principle of the reflection grating has been also applied by him to directional aerial systems for short-wave wireless transmitters, which are being used in America, and he has improved a number of optical instruments, amongst which are the Rayleigh refractometer and (in conjunction with Mr. F. Twyman) the Fabry-Perot interferometer.

National Inland Water Survey

IN the discussion which followed the reading of Dr. Brysson Cunningham's Paper on National Inland Water Survey, a summary of which appears on p. 443 of this issue, Vice-Admiral Sir Percy Douglas, the chairman of the British Association Research Committee on the subject, described the work of the Committee subsequent to the date of the reception of the deputation by the Minister of Health, and expressed the gratification which he felt at the unanimous agreement of the members of the Committee on a draft outline of the scope of the survey which had been drawn up and forwarded to the British Association, and which he hoped would be recorded in the *Geographical Journal*, for which purpose he read the several items. Dr. H. R. Mill spoke of the association of the Royal Geographical Society with water survey, and alluded in particular to the observations made on the Exe and the Medway with which he had been connected. Sir Henry Lyons, chairman of the new Survey Committee, welcomed the interest taken in the matter, and said that as his Committee had only just met quite recently for the first time, it would be premature at present for him to express any views on the course of action which he and his colleagues might decide to take. Capt. W. N. McClean described the more important features of River Flow Records, and showed how he had built up an organisation which he considered might be of great assistance in the work of river and stream gauging. Mr. G. J. Griffiths, chief engineer of the Thames Conservancy Board, emphasised the value of river flow records and the advantage which had accrued from having prolonged observations at Teddington and elsewhere; he considers a national survey to be long overdue. Dr. Bernard Smith dealt with the importance of observations relating to underground water and the necessity of prosecuting researches thereon in all practicable directions.

Preservation of Sites of Scientific Interest

THE British Association has recently been receiving from the Ministry of Health information of all schemes in progress under the Town and Country Planning

Act, in order that if any of these should disclose any risk of the destruction of sites or objects of scientific interest, representations may be made on behalf of the Association to the planning authorities and to the Ministry. In addition to natural features, or possibly buildings, which may be worthy of preservation on scientific grounds alone, it is clear that there must be many areas worthy of protection on grounds of amenity, and at the same time of sufficient scientific interest, whether geological, botanical or otherwise, to justify adducing arguments from the side of science in their favour. The first step taken by the Council of the Association was to communicate with all the local societies in correspondence with the Association, inviting their attention to the subject of planning and asking for information on any instances in which the Association might usefully take action: only a few have as yet come to hand. The whole subject will come under consideration at the Norwich meeting of the Association, when it will be dealt with by Prof. P. G. H. Boswell in an address as chairman of the Conference of Delegates of Corresponding Societies. Meanwhile the Council has appointed a panel of some sixty prominent members representative of geology, geography, botany and zoology, any of whom may be called upon for advice in connexion with proposals for preservation, and all of whom have been asked to bring to the notice of the officers any examples which may have come under their personal notice.

Roman Villa near Lydney

A NEW Roman villa on the River Severn near Wollaston, between Lydney and Chepstow, of which the discovery and partial exploration is described in *The Times* of March 8, illustrates the perennial character of the human response to an enduring need. A fire-platform and lighthouse in alignment mark the channel through the Guskar Rocks guarding the creek, on which the villa is situated, in a manner which might stand in a modern sailing direction. Before the examination of the site the existence of the creek, which had silted up, was indicated only by a stream in a depression; but evidently it must have been, with Lydney harbour, a port of call of importance, probably in relation to the iron-workings of Ariconium (Weston-under-Penyard) to the north. In any event, the villa with its sea-frontage was not only the centre of a wide settlement, still unexplored, but it is remarkable also for the unusual amount of iron it has yielded among its relics. The earlier villa, upon which a second was superimposed, was erected about A.D. 130 in the reign of Hadrian. It stood about 250 yards from the shore. It was of considerable size and contained nine rooms and a corridor and had a bath system along the sea front. One hundred and seventy years later it was destroyed, possibly, it is thought, by an Irish raid. After a lapse of twenty years, the second, a smaller building, was erected. It contained only four rooms, but it also had a bath system. This villa lasted for about a century. The details of the buildings and the associated relics have provided a number of noteworthy features, and the further examination of the site, which depends, as usual, upon funds being raised, will undoubtedly well repay the expenditure of time and money.

Irish Folk-lore

THE appointment by the Irish Free State of a Commission on Irish folk-lore is an extension of the active interest already shown by the authorities in the antiquities and history of Ireland that will be welcomed by all students of her traditions and ancient culture. The Commission is to be comprehensive in scope. It will arrange for the collection, collation and cataloguing of both oral and written folk-lore material, and also, if thought desirable, for the publication of such material. The scheme for collection which has been drawn up includes provision for a body of collectors who will travel through the country for the purpose of taking down by means of recording machines not only tales and songs, but also, among the older members of the community, their recollections of life in the country-side in their young days. Subject to the approval of Dail Eireann, a sum not exceeding £3,250 a year, for a period of five years, will be devoted to the work of the Commission. Although Ireland, in comparison with other parts of the British Isles, has not been badly served in the matter of attention from the collector of local lore and legends, it has always been known that extensive tracts of tradition and custom remained untouched; and notwithstanding the sophistication which has affected Ireland in common with other countries of recent years, the remoter districts still retain much of their primitive character and tradition. In addition to its work of collection, the Commission's activities will afford an opportunity for that systematic treatment of the material for which adequate opportunity has not hitherto been available, but which in dealing with conditions in Ireland is highly desirable.

British Museum Acquisitions

AMONG the notes on recent acquisitions by the British Museum in the *British Museum Quarterly*, 9, No. 3, particulars are given of sources from which came part of the sum required to make up the initial payment for the Eumorfopoulos collection of Chinese and Far Eastern art, and progress is reported in the allocation of the collection to Bloomsbury and South Kensington. A contribution of £5,000 was received from the National Art Collections Fund, £5,000 from Sir Percival David and £1,000 from the Universities' China Committee in London. The bequest to the British Museum and the Victoria and Albert Museum of three quarters of the residue of the estate of the late J. R. Vallentin for the purchase of works of art for the two museums was also allotted to this use. It is stated that the collection is so large that it will be possible to place a certain number of pieces on loan in some of the leading provincial museums. When, however, the scheme for a Museum of Oriental Art comes into being, it is intended to recall these loans, and the whole collection will be brought together again to form an important part of what, it is hoped, will be the finest museum of oriental art

in existence. Parts of the collection already have been, or are in course of being, described, but accounts of special classes of exhibits are to be prepared and published from time to time. Among other notes in this issue of an interesting publication which is not so widely known as it deserves, is an account of the fragments of the unknown gospel acquired last summer, to which Mr. H. L. Bell has recently directed attention in *The Times*, and descriptions with illustrations of an Egyptian wax figure which, if it be, as is thought, a model for making moulds for casting bronze figures, is indeed rare, and some unique objects of a varied nature from Roman London.

Empire Cotton Growing Corporation

AT a meeting of the Administrative Council of the Empire Cotton Growing Corporation held in Manchester on February 7, the resignation was received of Mr. Milligan, who has been the Corporation's senior representative in Africa since 1924. During this time he has travelled constantly about South Africa and visited in addition the Corporation's staff in Swaziland and Rhodesia. He has been succeeded by Mr. Parnell, who has long been associated with the Corporation's work in South Africa. The Council received the report of Mr. May, assistant secretary of the Corporation, upon a tour he had recently made in East and South Africa, particularly with reference to developments in Tanganyika Territory. At many places in this territory, the Corporation's assistance will be used towards developing an interesting scheme, evolved by the Agricultural Department, for native holdings on which cotton will be grown in a system of mixed farming. Each family will be given the freehold of their holding, which will consist of 20 acres. Of these, 10 acres will be reserved for cattle grazing, and the remainder for the dwelling site and land for the cultivation of cotton and other crops. The natives will also be given instruction in the preparation and use of farmyard manure.

THE Mwanza area of Lake Province has hitherto produced about half the cotton grown in Tanganyika. The organisation of its seed supply is therefore a matter of importance, and with the help that is now being given by the Corporation it is hoped to put this on a satisfactory basis. The selection of the best strains will be carried out at the Experiment Station at Ukiriguru; these will then be multiplied in the special area that is being provided for the purpose, just across the arm of Lake Victoria known as Smith Sound. The seed from this area will be bulked on an island in the Lake, which makes an admirable isolated area where admixture of the strains can be prevented. The bulked seed will then be distributed in the following season throughout the Lake Province.

Forest Research in the Malay States

THE annual report of the Forest Research Branch, 1933, is issued with the "Report on Forest Administration for the year 1933 of the Federated Malay States" (a Supplement of the *F.M.S. Government Gazette*, June 15, 1934. F.M.S. Government Press). Research, under which is included education, has made considerable progress in the Forest Department of the Federated Malay States. A Forest School has been started much on the lines of the Rangers' School at Dehra Dun, India, which has nearly half a century of good work behind it. The practical courses of the Malay School during the year under view included a forest reconnaissance in mountainous jungle in the State of Perak; it served the excellent purpose, among others, of acquainting the students with commercial tree forms not normally encountered in the lowland forests. An area of 2,400 acres of this hill forest in the Bubu reserve was explored and the enumeration work was conducted on more intensive lines than hitherto, both as regards composition of the crop and the possibility of commercial exploitation. This appears an excellent departure and the experience thus gained should be invaluable to all, whilst the work achieved will be of practical value. Research work is being carried on in sylviculture, where some interesting research work is being achieved, botanical, wood technology, timber testing, wood preservation and forest economy generally; while zoological, chemical and meteorological problems are being studied.

The National Herbarium at Melbourne

THANKS to the generosity of Sir MacPherson Robertson, a new building has just been completed in Melbourne for the housing of the National Herbarium collections, and the transfer of material is in progress. The building is a block, approximately 100 ft. by 80 ft., containing two floors. On the upper floor provision is made for the collections (numbering some 1,500,000 sheets) and for a library of more than 10,000 volumes. On the lower floor are a museum of economic botany, a laboratory, a lecture hall and the administrative offices. The construction is fire-proof throughout; all cabinets are of steel and the main door is guarded by fire-proof devices operating automatically when the temperature reaches a certain point. The collection was commenced about 1856 by the late Baron von Mueller, and it is intended to preserve the existing division into two sections (i) Australian and (ii) extra-Australian. The former is very complete and contains a number of type specimens. The room allotted to it is 60 ft. by 35 ft., allowing for 30 per cent expansion, or 55 per cent if further cabinets be installed. The extra-Australian section, which is already extensive and is continually growing by exchanges, will be housed in a room 80 ft. by 35 ft.

Sounds made by Fishes in the East Indies

IN NATURE of November 17 (p. 769), we quoted an interesting account of sounds heard in the East Indies by Capt. P. Jansen. We have received a letter from Dr. J. D. F. Hardenberg, of the Laboratory for Investigation of the Sea, Batavia, with reference to this note. He states that the comparison of these noises with the sounds made by foghorns is quite correct. They remind one also of the sounds made by motor traffic on a busy thoroughfare when heard at a distance of about a hundred yards. The noises, however, do not proceed from the earth, but are

made by fishes of the genus *Therapon*, as described by Dr. Hardenberg in a recent paper (*Zöol. Anz.*, **108**; 1934). The other sounds mentioned by Capt. Jansen have also been heard by Dr. Hardenberg, though less frequently, and once, when in the Java Sea, he heard sounds as if made by silver bells. Their origin is still unknown, but he supposes that they are also made by animals.

American Society for Testing Materials

IT is a great help to industry to have standard specifications for the materials used in commerce, and to have methods of testing to find out whether the materials offered for sale come up to the standard or not. In Great Britain the British Standards Institution (B.S.I.) of 28 Victoria Street, S.W.1, publishes standard specifications and gives also the methods of testing. These have been passed by committees consisting of engineers, manufacturers, Government officials and all interested in securing raw materials or finished products of the best quality. If experience shows that the methods used are ineffective, then the old committee meets again or another committee is formed and it brings out a revised specification. In the United States, the American Society for Testing Materials (A.S.T.M.) performs similar functions. The *Proceedings* of this Society are issued annually, and give reports by committees and the 'tentative' standards adopted. Each of the annual volumes contains about 2,000 pages. In the 1934 volume such subjects as vapour lock of petrol, creep tests and data, soil testing methods, rubber raw materials, etc., are discussed. Twenty-one of the standards appearing in the 1933 "Book of Standards" have been revised or discontinued. Fourteen of them have been revised, five of them have been replaced by new tentative standards and two have been completely withdrawn. The new problems discussed will be found of interest by physicists, and open up new fields of research.

Society of Public Analysts

AT the annual general meeting of the Society of Public Analysts held on March 6, Dr. Bernard Dyer gave an address embodying his reminiscences of the Society, from its inception to the present day. At the outset of his address, Dr. Dyer pointed out that the occasion was particularly appropriate, since it was the diamond jubilee of the Society, which held its first meeting in February, 1875, when Dr. Redwood was elected president. Much of the early work of the Society was concerned with food adulteration, which at that time was gross and widespread, although gradually analytical chemistry in general was brought within the scope, and in 1906 this was recognised when the title of the Society was enlarged to include analytical chemists other than public analysts. Several of the earlier presidents were well known as medical officers of health, who had also been appointed public analysts. Dr. Dyer also touched on the history of the Society in connexion with the Institute of Chemistry and the Government Laboratory, and laid stress upon the fact, that in spite of certain coolness and misunderstandings in earlier days, the most cordial relations have for many years existed between the Society and these bodies. The following officers were elected for 1935: *President*, Mr. John Evans; *Vice-Presidents*, Messrs. L. H. Lampitt, S. E. Melling, A. More, W. H. Roberts; *Honorary Treasurer*, Mr. E. B. Hughes; *Honorary Secretary*, Mr. G. Roche Lynch.

Hydrogen Cooling

THE losses due to air friction when machines are rotating is often an appreciable fraction of the total working losses. The losses can be considerably reduced by running the machines in hydrogen. As the thermal conductivity of hydrogen is much greater than that of air, the temperature rise of the machine is further reduced and so it can be run at a heavier load and can therefore be rated as a more powerful machine. In the *Electrician* of March 1, there is a description of a 30,000 kilovolt ampere synchronous condenser which has been built for the French Midi Railway. The outer casing is built up of steel plates bolted together and designed to withstand the force of any internal explosion which might occur owing to a mixture of hydrogen and air. The machine is started by a special type of transformer which only takes a quarter of full load current. Tests carried out on the machine with hydrogen and air as cooling media show that the heating of the machine with hydrogen-cooling was thirty per cent less than when it was run in air.

The Murdoch Trust

THERE has been in existence for a number of years a most admirable trust, known as the Murdoch Trust, for the benefit of indigent bachelors and widowers who have done good work for science and have fallen on less prosperous days. Few people seem to be aware of the existence of this Trust or of its beneficent purpose, though a modest advertisement occasionally appears, as, for example, in NATURE of March 2, p. lxvi, inviting applications for donations or pensions from it. We gladly direct attention to the aid thus available to persons who have promoted or helped the advancement of any branch of science and are in need. The Trustees welcome applications from scientific workers eligible for assistance from the funds they have available. Particulars can be obtained from Messrs. Shepherd and Wedderburn, 16 Charlotte Street, Edinburgh.

Ibero-Americana Oceanographical Conference

THE Ibero-Americana Oceanographical Conference was to have met at Madrid in October last, but it was found necessary to alter the date, and the assembly of the delegates was postponed until the latter part of April 1935. As at present arranged, the Conference will hold its meetings partly in Madrid and partly in Malaga. Invitations to attend were sent to the Governments of the various North and South American States and to the Governments of those countries having territories in America. It is understood that the Conference will discuss

measures for obtaining oceanographical data of all descriptions in the oceans and waters adjoining their coasts, including the study of ocean currents, marine meteorology and fisheries. Having regard to the existence of the International Association of Physical Oceanography of the Sub-Committee for Oceanography of the Pacific Science Congress, however, and of various bodies dealing with marine biology and fisheries, it is doubtful whether the creation of yet another is desirable or can serve a useful purpose. The General Secretary is Señor Rafael de Buen, Alcalá, 31, Madrid.

New Land Speed Record

SIR MALCOLM CAMPBELL set up a new motor speed record on Daytona Beach on March 7, by obtaining a speed of 276·816 miles an hour. The previous record, also set up by Sir Malcolm, on February 22, 1933, was 272·108 miles an hour. The figures for the time to cover the measured mile work out as follows: first run, 272·727 miles an hour (13·20 seconds); second run, 281·030 miles an hour (12·81 seconds); average speed, 276·816 miles an hour. Sir Malcolm's car, *Bluebird*, was designed by Mr. R. Railton, and contains a 2,500 horse-power Rolls-Royce Schneider Trophy engine.

Announcements

PROF. W. N. HAWORTH, director of the Department of Chemistry, University of Birmingham, was elected a corresponding member of the Bavarian Academy of Sciences on February 16.

THE Bessemer Gold Medal for 1935 of the Iron and Steel Institute has been awarded to Prof. A. M. Portevin, director of the Institut de Soudure Autogène, professor at the Ecole Supérieure de Fonderie, and at the Ecole Centrale des Arts et Manufactures, Paris.

THE D'Arsonval prize has been awarded by the Société française d'électrothérapie et de radiologie to the Belgian physician Dr. Etienne Hubert Henrard, for a thesis on "Short Hertzian Waves and their Medical Applications".

PROF. H. LEVY will deliver a lecture on "Science and Social Responsibility" before the Institution of Professional Civil Servants on March 22 in the lecture hall, Royal Society of Arts, John Street, Adelphi, W.C.2. The chair will be taken by Mr. H. T. Tizard. Tea will be served at 5 p.m. and the chair will be taken at 5.30 p.m. Admission is free and tickets of admission are not required.

THE Royal Society of Arts has recently announced the subjects for the Thomas Gray prizes to be offered in 1935. One prize of £100 will be awarded for an "invention, publication, diagram, etc., which . . . is considered to be an advancement in the Science or Practice of Navigation". The other prize will be awarded for the best essay on "Modern Navigational Appliances." Further information can be obtained from the Secretary, Royal Society of Arts, John Street, Adelphi, London, W.C.2.

THE following appointments have recently been made by the Secretary of State for the Colonies: Mr. H. Atkinson, to be deputy Government analyst, Ceylon; Mr. J. R. E. Hindson, inspector of plants and produce, to be assistant superintendent of agriculture, Gold Coast; Mr. A. H. Malpas, assistant marine biologist, to be director, Colombo Museum, and marine biologist, Ceylon; Mr. D. B. Sabiston, deputy superintending produce inspector, to be superintendent of agriculture, Nigeria.

AT the annual general meeting of the Institute of Metals, held on March 7–8, the following officers were elected for 1935: *President*, Dr. H. Moore; *Vice-Presidents*, Mr. W. R. Barclay, Dr. C. H. Desch, Dr. A. G. C. Gwyer, Prof. D. Hanson, Mr. H. C. Lancaster, Mr. E. L. Morcom; *Honorary Treasurer*, Mr. John Fry.

THE Royal Astronomical Society is prepared to issue (provided sufficient support is forthcoming) a third edition of the Franklin-Adams Chart of the Sky, in 206 sheets, each covering an area 15° × 15°. The Chart is in three sections: (1) North Pole to Dec. + 22°, (2) Dec. + 22° to − 22°, (3) Dec. − 22° to South Pole. The price of the complete set, in three cases, has been fixed at £27, including carriage. Should any desire one or two of the sections only, subscriptions will be received for the part required at a corresponding rate. Further particulars, and application forms, may be obtained from the Assistant Secretary, Royal Astronomical Society, Burlington House, London, W.1.

APPLICATIONS are invited for the following appointments, on or before the dates mentioned:—A temporary assistant engineer in the Headquarters Offices of the Ministry of Transport—The Establishment Officer, Ministry of Transport, Whitehall Gardens, S.W.1 (March 18). A lecturer (woman) in biology and nature study in the Saffron Walden Training College, Essex—The Principal (March 22). A lecturer in physiology, an assistant lecturer in mathematics, and an assistant lecturer and demonstrator in housecraft at Brighton Technical College—The Secretary, Brighton Education Committee, 54 Old Steine, Brighton, 1 (March 29). A lecturer (woman) in biology and natural history in the Diocesan Training College, Derby—The Secretary (April 1). A professor of physiology in the King Edward VII College of Medicine, Singapore—The Director of Recruitment, Colonial Service, 2 Richmond Terrace, Whitehall, London, S.W.1 (April 8). Two lecturers in mechanical engineering at the Lester Technical Institute, Shanghai—The Lester Trust, c/o Messrs. Viney, Price and Goodyear, Empire House, St. Martin's-le-Grand, E.C.1 (April 8). A chief mining engineer for the Northern India Salt Revenue Department—The High Commissioner for India, General Department, India House, Aldwych, W.C.2 (April 10). Assistant keepers in zoology, entomology, geology, mineralogy, and botany in the British Museum (Natural History), London, S.W.7—The Secretary (May 31).

Letters to the Editor

The Editor does not hold himself responsible for opinions expressed by his correspondents. He cannot undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of NATURE. *No notice is taken of anonymous communications.*

NOTES ON POINTS IN SOME OF THIS WEEK'S LETTERS APPEAR ON P. 437.

CORRESPONDENTS ARE INVITED TO ATTACH SIMILAR SUMMARIES TO THEIR COMMUNICATIONS.

The Period of Radionitrogen

IN their first communication on induced radioactivity, Curie and Joliot[1] reported that a radioactive isotope of nitrogen was formed from boron by bombardment with α-rays according to the scheme:

$$_5B^{10} + {}_2He^4 \rightarrow {}_7N^{13} + {}_0n^1.$$

The period was about 14 minutes and they carried out chemical tests which helped to identify the radioactive body. We[2] also investigated this reaction and found a period of about 14 minutes. It was shown by Cockcroft, Gilbert and Walton[3] that this isotope of nitrogen could be formed from carbon by bombardment with either protons or deutons, but that the period in this case was about 11 minutes. This latter result has been confirmed by several observers. If this difference in the periods could be maintained, it would suggest a number of interesting possibilities. It has, for example, been used as an argument in favour of the existence of the negative proton.

The chief uncertainty in our former experiments was that, as the activation was carried out in air, we always obtained in addition radiofluorine formed from nitrogen:

$$_7N^{14} + {}_2He^4 \rightarrow {}_9F^{17} + {}_0n^1.$$

Radiofluorine has a period of about 1 minute, and about half of the initial activity of the 'boron source' was due to radiofluorine. It was therefore impossible to start measurements on the radionitrogen until 6–10 minutes had elapsed, and, as the total effect was always small, it was of little use to extend the measurements over more than 30 minutes.

The new experiments have been done under improved conditions, yielding larger counts, and the occurrence of radiofluorine has been almost completely suppressed by activating *in vacuo*. As a result, we could now start counting 2 minutes after the removal of the boron from the source of α-rays and continue the counting for more than an hour. We have counted 16,660 particles in all in seven such experiments and the periods obtained are:

Number of Particles.	Period in minutes.	Mean square error.
1817	10·4	0·4
1619	11·5	0·5
1378	10·8	0·5
5220	11·3	0·2
3124	11·1	0·2
1980	10·8	0·3
1524	11·1	0·4

The final value for the period obtained by combining all the measurements is 11·0 minutes, with a mean square error of 0·1 minutes. This value is the same, within the limits of error, as that obtained for the period of $_7N^{13}$ formed from carbon, namely, 11·0 ± 1 minutes, and it seems therefore that the bodies are identical.

While we plotted the decay of the activity in the usual way, to verify that it was exponential, the above values were obtained by a computation from the observed counts in successive intervals of time according to a method developed by Dr. Peierls. This method is considerably more dependable than the ordinary rough graphical one, since it takes into proper account and uses the fact that the measurements are subject to probability fluctuations. With the graphical method it is impossible to determine the probable error, and there may be a tendency to average the positive and negative fluctuations occurring close to each other in time, instead of striking the proper average over the whole time of measurement.

We have also carried out a rough analysis of the particles, as regards sign of charge, by means of a magnetic field, and have found no evidence of any negative emission from activated boron. The results with positive and negative magnetic fields were much the same as when using activated aluminium (radiophosphorus), or, though in the reverse sense, using a very weak source of thorium C. It is at present uncertain to what extent the reaction,

$$_5B^{11} + {}_2He^4 \rightarrow {}_6C^{14} + {}_1H^1$$

occurs. The above result is compatible either with a small yield from this reaction or a small mass difference between C^{14} and N^{14}.

We are very grateful to Dr. Peierls for supplying us with full details of his method of calculating the periods.

C. D. ELLIS.
W. J. HENDERSON.

Cavendish Laboratory,
Cambridge.
March 1.

[1] NATURE, **133**, 201; 1934.
[2] NATURE, **133**, 530; 1934.
[3] NATURE, **133**, 328; 1934.

Do Whales Descend to Great Depths?

WITH reference to the letter of Mr. R. W. Gray in NATURE of January 5, p. 34, the depth to which whales may descend when diving has long been the subject of speculation.

The theory that whales reach great depths is based upon observations made by whalers and others upon the length of harpoon line carried out and its apparent behaviour at the surface. It is also based upon the duration of the dive, long submergence having been frequently taken to imply great depth of descent. The discovery of carcasses of whales at great depths entangled in submarine cables, and stories of a similar nature, have also contributed to this theory. These are in no case reliable as evidence, since there is no possible means of knowing how the carcasses reached the positions in which they were said to have been found.

Apart from the fact that the length of harpoon line carried out and the apparent behaviour of the line at the surface are somewhat doubtful guides to the movements of the whale at the end of it, the

greatest caution must be exercised in deducing the normal life habits of a whale from its behaviour on being struck by a harpoon. It is probable that the whale reacts in an abnormal manner to so violent a stimulus, making, perhaps, a plunge into depths far beyond its safety limit. That this does happen seems to be indicated by the fact, mentioned by Mr. Gray, that whales have been known to die beneath the surface after taking such a plunge and have had to be hauled up, occasionally, it is said, with a broken jaw bone.

It is the depth to which a whale may normally descend during the ordinary course of its existence which is alone of interest in the present discussion, and it is doubtful whether evidence with regard to this will ever be obtainable. Those who hold that whales do not, in fact, normally descend to very great depths base their opinion on two, possibly three, considerations.

(1) It is uncertain what the effect of hydrostatic pressure would be upon an animal like a whale diving with its lungs closed. All the organs, the lungs among them, will be compressed. Some protection may be afforded to the lungs by the ribs, but it is still not far wrong to say that the lungs will be compressed to one half their normal volume at 2 atmos. pressure, to one third at 3 atmos., absolute pressure, and so on. Thus, quoting the smallest figures cited by Mr. Gray, if a whale which carries out 200 fathoms of harpoon line were actually to dive to that depth, its lungs would be compressed to considerably less than 1/35 of their normal volume. (Absolute pressure increases by 1 atmos. every 33 ft. of descent.) It seems impossible that the animal could survive anything approaching this compression.

(2) No mechanism has yet been discovered by means of which whales could avoid 'caisson' sickness on returning swiftly to the surface from great depths. The 'retia mirabilia' with which all Cetacea are provided do not seem to have any connexion with this, since they are present in seals and porpoises, which inhabit shallow waters, but can remain submerged for long periods. Their function would seem to be concerned rather with the time of submergence than with its depth.

It is possible that the great whales, owing to the high contractility of the alveolar walls and the slower circulation rate common to all large animals, are less susceptible than other mammals to 'caisson' sickness. The ductus arteriosus also remains open throughout life and may shunt off part of the pulmonary circulation. But if the physiology of the whale is in any way comparable with that of other mammals, the depth to which the animal may descend without incurring the risk of 'caisson' sickness on returning to the surface will not be enormously greater than that to which a man may descend. The safety limit for a man lies at a depth of 7 fathoms. It is possible that the safety limit for a whale might be at twice, three times or four times, even five times, the depth of that for a man, but highly improbable that it would be at 28½ times (200 fathoms) that depth.

(3) Rorqual whales in the south feed on 'krill', *Euphausia superba*. This crustacean forms dense swarms, on which the whales feed, at the surface, and is very seldom taken in quantity in plankton nets below 200 m., while the large majority are taken above 100 m. Thus there seems to be no special need for the rorqual whales, at any rate, to descend much below 100 m. during the normal course of their lives.

Sperm whales feed on cuttlefish. There is no evidence as to the depth at which these cuttlefish live. They have never been taken in nets or trawls and it has therefore been assumed, without justification, that they live at great depths.

F. D. OMMANNEY.

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Feb. 18.

Anomalous Scattering and Structure of Light Nuclei

THE method of analysing the anomalous scattering which has recently been developed by Wenzel[1] leads to a more detailed interpretation of the scattering phenomena, and furnishes results which so far are in excellent agreement with the other evidence available for the energy level system for light nuclei.

In Fig. 1 the lowest energy levels for a simplified nuclear model are given. The 'normal' sequence of these terms is represented by: 1*s*, 1*p*, 1*d*, 2*s*, 1*f*, 2*p*, 2*d*, 3*s* . . . etc.

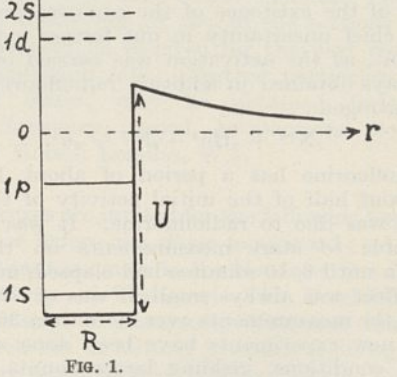

FIG. 1.

The dotted levels in Fig. 1 are unstable (virtual energy levels) in the special case for which Fig. 1 has been drawn. We notice that if we deepen our potential hole U, more and more of the indicated levels become consecutively stable, and vice versa. Under the actual conditions the virtual energy levels of small positive energy determine the character of the anomalous scattering (resonance scattering).

The analysis of Pose's experiments on the collision of α-particles with protons[2] shows that the scattering is mainly due to a resonance with the virtual $1p$-level of the proton in the field of an α-particle; and thus will be described as a $1p_p$-scattering (the index p referring to a proton level).

This is in agreement with what we know about the α-particle. The $1s_p$-level is stable and occupied by two protons and two neutrons. The next level, however, is already unstable and no Li^5- and probably no He^5-nucleus is likely to exist.

If we increase the weight of the nuclei, the depth U of the potential hole is increased. Thus we must expect that in higher nuclei successively, $1d_p$-, $2s_p$- . . . etc. scattering will occur. No other experiments, however, are available at present for proton scattering.

Very similar behaviour is to be expected for neutron scattering.

If we use the model of Fig. 1 to build up the lighter nuclei (up to A^{36}) from protons and neutrons, we obtain exactly the scheme proposed by Bartlett. We notice, however, that for many processes this scheme has to be replaced by others which are more adequate. If we deal, for example, with α-particles, it is more convenient to speak about α-particle levels in the nucleus.

Considering the anomalous scattering of α-particles, a similar picture to that of Fig. 1 must hold (but we have naturally to account for the Bose-statistics of these particles). We give here the analysis of the anomalous α-scattering by light nuclei:

$\alpha \rightarrow \alpha$: $1s_a$-scattering[3]
$\alpha \rightarrow Be^9$: $1p_a$-scattering[4]
$\alpha \rightarrow B^{10,11}$: $1p_a$-scattering[4]
$\alpha \rightarrow C^{12}$: $1p_a$-scattering[4]
$\alpha \rightarrow F^{19}$: $1d_a$-resonance disintegration (?)[5]
$\alpha \rightarrow Al^{27}$: $1d_a$-resonance disintegration (?)[6]
$2s_a$-scattering[7]

It is easily seen that this analysis of the anomalous scattering is consistent with all our knowledge about nuclear energy levels.

A more complete report on this problem is to be published in the *Physical Review*.

G. BECK.
L. H. HORSLEY.

Department of Physics,
University of Kansas.
Dec. 31.

[1] *Z. Phys.*, **90**, 754; 1934.
[2] Pose and Diebner, *Z. Phys.*, **90**, 773; 1934.
[3] Rutherford and Chadwick, *Phil. Mag.*, **4**, 605; 1927. Taylor (*Proc. Roy. Soc.*, A., **134**, 103; 1931) accounts for this scattering by a $2s_a$—scattering. The $1s_a$—scattering accounts equally well for the experiments, and avoids all the difficulties discussed by Taylor.
[4] Rietzler, *Proc. Roy. Soc.*, A., **134**, 154; 1931.
[5] Pose, *Z. Phys.*, **72**, 528; 1931.
[6] Pose, *Z. Phys.*, **64**, 1; 1930.
[7] Rietzler, loc. cit.

The Phenomenon of 'Wings' and the Vibrational Raman Effect in Benzene and Naphthalene Crystals

As has been pointed out in our previous note[1], the continuous spectrum (wings) observed around the primary line at the scattering of light by liquids consists of two parts. The central part just near the primary line (*c.* 20 cm.$^{-1}$ in diphenyl ether) gains in intensity when the liquid is heated, whereas the outer part remains unaltered. By comparison of the Raman effect in liquid and crystalline diphenyl ether, we have shown that the later part is not due to the rotation of molecules in the liquids as usually accepted, but is produced by the vibrational Raman lines caused by slow vibrations (probably characteristic for the crystal lattice of diphenyl ether). It seemed to us of interest to include in our experiments also the crystal of benzene because the phenomenon of wings of this substance in the liquid state has been carefully studied by many observers[2].

We investigated the Raman effect of single crystals of benzene and naphthalene. The experiments have fully confirmed our previous results obtained with diphenyl ether. In place of the wings observed in liquid benzene and naphthalene, we have obtained very distinct vibrational Raman lines: $\nu_1 = 63$ cm.$^{-1}$ and $\nu_2 = 108$ cm.$^{-1}$ in the benzene crystal and $\nu_1 = 20$ cm.$^{-1}$, $\nu_2 = 38$ cm.$^{-1}$ and $\nu_3 = 94$ cm.$^{-1}$ in the naphthalene crystal. The new Raman lines are indicated by arrows in Fig. 1. The spectrogram showing the wings of liquid naphthalene is not reproduced, because it is similar to that of liquid benzene.

The central part of the continuous spectrum just near the primary line is of great intensity in the case of liquid naphthalene, and is probably connected with existence of a very large coefficient of depolarisation of the scattered light in this substance. We wish especially to emphasise that this part of the wings, the intensity of which increases on heating, is absent in the spectra of crystals (and, as it seems, in amorphous solids) and is apparently characteristic of the liquid state.

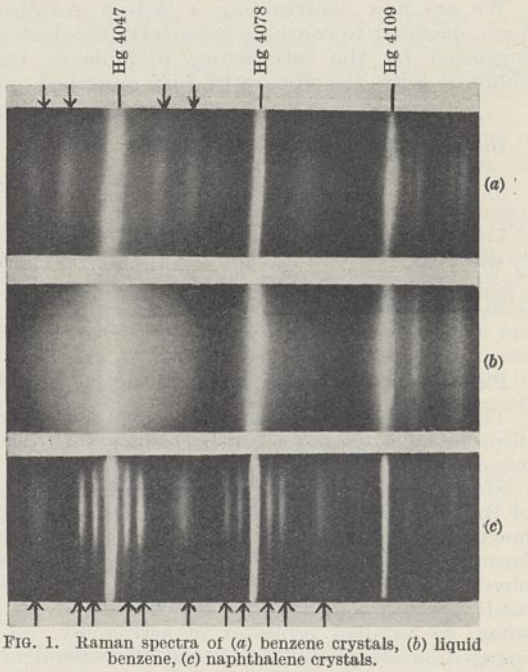

FIG. 1. Raman spectra of (*a*) benzene crystals, (*b*) liquid benzene, (*c*) naphthalene crystals.

It was found that there is a difference in the ordinary Raman spectrum of liquid and crystalline naphthalene. For example, the Raman lines $\nu = 211$ cm.$^{-1}$ and $\nu = 278$ cm.$^{-1}$ observed with the crystal are absent or at least very weak in the liquid. A detailed account of these variations will be published elsewhere.

E. GROSS.
M. VUKS.

Optical Institute,
Leningrad.
Jan. 2.

[1] NATURE, **135**, 100, Jan. 19, 1935.
[2] C. V. Raman and K. S. Krishnan, NATURE, **122**, 278, 882; 1928. *Proc. Roy. Soc.*, A, **122**, 23; 1929. I. Cabannes and P. Daure, *C.R.*, **186**, 1533; 1928. W. Gerlach, *Ann. Phys.*, **1**, 301; 1929. I. Weiler, *Z. Phys.*, **68**, 782; 1931. A. Rousset, *J. Phys. et le Rad.*, **3**, 555; 1932. S. P. Ranganadham, *Ind. J. Phys.*, **7**, 353; 1932. S. Bhagavantam, *Ind. J. Phys.*, **8**, 197; 1933. S. Bhagavantam and A. V. Rao, *Ind. J. Phys.*, **8**, 437; 1934.

A High-Pressure Wilson Cloud Chamber

FOR various investigations, such as for large range radiation or when ionisation occurs infrequently, it is an advantage to use high pressure in a Wilson cloud chamber[1]. We have developed a Wilson chamber of 2 cm. diameter in which pressure can be increased to 100 atmospheres. The desired compression and sudden expansion was obtained by a piston which followed the pressure of gas in a cylinder

below the cloud chamber. By this means, a sudden expansion in the cloud chamber was more easily obtained than by the usual mechanical means of moving a piston.

At 80 atmospheres of nitrogen saturated with water vapour, the practicability of a high-pressure Wilson chamber was confirmed. We found that for an expansion ratio of only about 17 per cent, condensation occurred in an ionised atmosphere (radioactive material was brought near the chamber); for a greater expansion ratio a general cloud was always present, and for a smaller expansion ratio no visible condensation occurred even in the presence of strongly ionising substances.

We are now constructing a Wilson chamber of 8 cm. diameter to continue investigations which were suggested by the satisfactory preliminary results obtained with the apparatus just described.

P. KIPFER.

Institut de Physique polytechnique
de l'Université Libre,
Brussels.
Feb. 18.

[1] Mott-Smith, L. M., *Rev. Sci. Instr.*, **5**, 346; 1934; and Brubaker, W. M., and Bonner, T. W., *Phys. Rev.*, **47**, 225, 1935. Description of a high-pressure Wilson chamber in which pressure can be increased to 20 atmospheres.

Plea for the Preservation of a Scientific Library

THE object of this letter is to avert the threatened dispersal of a unique scientific library with historic associations.

Stephen Peter Rigaud, the most eminent historian of British science of his day and professor of experimental philosophy at Oxford from 1810 until 1839, formed a valuable working collection of books on physics, mathematics and astronomy, of which he made great use during the last decade of his life, when, as Savilian professor of astronomy, he was engaged on his great "Works and Correspondence of Dr. Bradley", 1831, and the much quoted "Correspondence of Scientific Men of the Seventeenth Century", published posthumously in 1841.

Rigaud's library is not only of unique value for the history of a third of the nineteenth century and of the first Radcliffe Observers, but it also includes earlier works as well. That this collection, even at considerable cost, should be kept together in its entirety for the benefit of future students, is the view of Exeter College of which Rigaud was a fellow, and was the view of those Radcliffe Trustees who purchased the collection for historical purposes about the time when the Duke of Marlborough, Sir W. Heathcote, Mr. W. E. Gladstone and Mr. Peel, Speaker of the House of Commons, were managers of that trust for charitable purposes. Also, but a few months back, it was the view taken by the late trustees, Lord Chelmsford and Lord Grey of Fallodon.

The solicitor now writes that the present trustees are contemplating a sale by auction. They have, it is true, given a first choice of books to the Bodleian Library and a selection of pamphlets to the Lewis Evans Collection. But the elimination of the remainder will seriously detract from the scientific value of these portions.

Such a dispersal is believed not to have been their original intention. Before the death of Prof. H. H. Turner it was, I believe, arranged that the entire collection would go to the Savilian professor; and quite recently an offer of the un-donated part of the collection, including many appropriate books on instruments, was made to the Lewis Evans Collection on the condition that the Bodleian should agree to place its recently acquired Rigaud books so as to restore the integrity of the whole library. This, however, the Bodleian found impracticable.

There is now a need for these books in Oxford as never before. The gift of the instruments of the Radcliffe Observatory to the new Museum for the History of Science is only half a gift, if the instruments are unaccompanied by the books of those who used them. The collection of Rigaud pamphlets in the Lewis Evans Collection cannot be adequately dealt with, without contemporary books of reference of their collector. The need of books of historical interest is urgent.

Soon after 1860, when the University Museum of Science was first founded, the Trustees transferred their general library there, to the great and lasting benefit of the University. Now that the University has founded a Museum of the History of Science for ordinary study and historic research, will not the Radcliffe Trustees reaffirm their original policy by adding books to the instruments, pamphlets and manuscripts of Hornsby and Rigaud with which they have endowed the new institution?

Even at this eleventh hour it cannot be too late for the Trustees thus to signalise the worth of their own Observers, and by conserving the whole of the Rigaud library, to earn the gratitude of future historians by giving instead of depriving them of the opportunity of doing for Hornsby, Rigaud and others, what Rigaud with his private library did for Hariot, Bradley and Newton.

R. T. GUNTHER.

Museum of the History of Science,
Oxford.
Feb. 27.

The Concept of Time in Physics

IT would be in the highest degree ungrateful for me to cavil at Prof. Dingle's review of "The Serial Universe" in NATURE of February 9, and I have no intention of so doing. But his criticism of the immortality discussion—a criticism which has been made also by Prof. Stocks and Prof. Joad—arouses in me an uneasy feeling that the book has failed here to emphasise properly the salient points of the argument.

In all questions of continuity, the onus falls, of course, upon the contestant who asserts a boundary. The prisoner is presumed innocent until he has been proved guilty. That, indeed, is the only hope of observer 1, who is in the dock—on the circumstantial evidence of psychoneural parallelism and is pleading for the benefit of any vestige of doubt that may remain. But observer 2 is in a superior position. He is not even accused. He stands beyond the range of the old indictment.

The comment which has been made now is that observer 2, though unaffected by the death of observer 1, may, later on in his own time, encounter some death of a higher-order description. But here the law of the regress must hold. Observer 3, in his turn, would be unaffected by the death of observer 2. Thus, the receding ultimate observer must elude

always any kind of death that science will permit us to bring into the picture.

The only escape from this would be to prove that there is a death 2 which, necessarily, *accompanies* death 1—to prove that the observer must die when his instrument breaks. That is what I have sought for throughout the last nine years, and cannot find. Apparently, such simultaneous (in absolute time) destruction of all the infinite series of observers would demand a miracle.

Similar considerations apply in the question of free-will. We may construct, at any stage of the regress, a picture which will include both subject and object; and, in that picture, determinism will reign supreme. But the ultimate observer (who is, incidentally, the draughtsman) remains outside the world thus pictured, and with power to intervene. Prof. Stocks urges that this is merely an infinite series of evasions of the question. Yet, surely, it is clear that what is evaded is not the question, but the determinist verdict. The ultimate observer is not the slave of any constraint that his science can picture.

When no death can overtake you, and no objective circumstance can compel your choice: that is immortality, and that is free-will. But the really interesting thing is that, when these intuitive claims of our consciousness are recognised in that serial fashion which is the essential foundation ('nominalist' or otherwise) of the time picture, then—and not until then—does the world of physics become rational.

J. W. DUNNE.

Hotel Vernet,
Territet, Canton Vaud,
Switzerland.
Feb. 15.

I THOUGHT Mr. Dunne's demonstration that time as it is used in physics, is a mathematical device which is justified because, and to the extent that, it is adapted to the interpretation of experience, one of the most valuable parts of his book. It seems to me inadmissible to deduce qualities of experience from the character of a device voluntarily adopted to interpret it. Experience is not at the command of the arbitrary machinery of logic.

This seems to me almost axiomatic, but it might not be superfluous to go from the general to this particular case. If time is regarded merely as an indefinitely extended continuum—as in much physical work it is—it is not suitable for the complete correlation of our experience, because the fact that we necessarily move along it in a single direction is omitted. We must therefore supplement this conception (T_1) by the addition of such a movement, thereby introducing T_2. T_2 thus earns recognition only because it repairs the inadequacies of T_1. As Mr. Dunne admirably shows (pp. 35–36), it was not inherently necessary to start with an inadequate conception. We can describe a fraction as 1/3 or as 0·3, but if we adopt the second form it is necessary to continue beyond the first decimal place; and, in the matter of time, field physics has not done so. But to jump from that to the *independent* significance, of T_2, in which the observing experiencing individual may survive after he has ceased to be in T_1, is logically impossible. One-third is insufficiently represented by 0·3, but it is still worse to call it 0·03.

If one has to say 'yes' or 'no' to the survival question, I agree with Mr. Dunne that the onus of proof is on those who say 'no', but in science, unlike English law, 'Not Proven' is a possible, and often the only possible, verdict. I think it is so here.

HERBERT DINGLE.

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and Technology,
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Feb. 19.

Spectrum of Nova Herculis, 1934

THE emergence of a displaced *B*-type absorption spectrum at the end of February, coupled with a drop in brightness to $3{\cdot}5^m$–$4{\cdot}0^m$, suggests that, after a most unusual life-history of two months, the nova is now developing along more normal lines. Accompanying the O II and N II absorption lines—displaced with a velocity of about − 900 km./sec.—there is to be seen an undisplaced bright band of [N II] at 5755·56. This can be traced back on the spectrograms to January 22.

We should like to correct our previous statement[1] that the forbidden lines of O I at 5577, 6300, 6363 A. had not previously been found in novæ. Dr. W. H. Wright observed the lines in Nova Ophiuchi, 1919[2], but the lines could not then be identified as [O I]. It is of interest to note that, while in the aurora and the night sky spectra, 5577 is the strongest line and in the nebula it is too weak to be observed, it is found in the nova of varying strength, but frequently about the same strength as 6363.

A. BEER.
F. J. M. STRATTON.

Solar Physics Observatory,
Cambridge University.
March 5.

[1] NATURE, **135**, 346; 1935.
[2] *Pub. of the Lick Obs.*, **14**, 12; 1920.

A Blue Flame in the System N_2O_5/O_3

WHEN dry nitric anhydride is vaporised in a stream of ozonised oxygen, and then passed through a glass tube heated by a small flame, the colourless gas becomes brown, through the formation of nitrogen dioxide, a short distance before the flame is reached. A narrow zone of a dark grey-blue colour is, however, seen hovering at the boundary, and this is preceded by a zone of clear blue. In a long tube, the blue flame thus formed 'strikes back' from time to time, at the rate of about 10 cm. per second, to the point at which the gas enters the tube, which is then filled from end to end with brown nitrogen dioxide. When the concentration of nitrogen pentoxide is low, the grey boundary between the colourless incoming gas and its pale brown decomposition products remains stationary and does not strike back.

It is suggested that the formation and disappearance of the blue zone may be due to the production and decomposition of a higher oxide of nitrogen; for example,

$$N_2O_5 + O_3 = 2\,NO_3(\text{blue}) + O_2;\quad 2NO_3 = 2NO_2 + O_2.$$

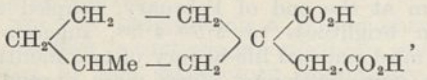
The temperature at the boundary is probably below 100°.

T. M. LOWRY.
J. T. LEMON.

University Chemical Laboratory,
Cambridge.
Feb. 15.

Isomeric Forms of Complex Acetic Acid

THE synthesis of 1-carboxy-3-methyl*cyclo*hexane-1-acetic acid by Higson and Thorpe's method[1] gave rise to a small amount of the acid, m.p. 163°, originally obtained by oxidation of α-keto-3-methyl*cyclo*hexane-1 : 1-diacetic acid[2], accompanied by a low melting point gum which was ultimately resolved into a mixture of two crystalline isomers of this. The application of Lapworth and McRea's synthesis[3], on the other hand, gave a more satisfactory yield of the acid melting at 163°, accompanied by only small amounts of the other isomers. The isolation of three forms of the acid,



is explicable only on the basis of the assumption of a strainless form of the methyl*cyclo*hexane ring, and the corresponding acids obtainable from 3 : 3-dimethyl*cyclo*hexanone are therefore being investigated in this laboratory. A full report will be published elsewhere in due course.

R. D. DESAI.
R. F. HUNTER.

Department of Chemistry,
Muslim University,
Aligarh.

[1] *J. Chem. Soc.*, **89**, 1455 ; 1906.
[2] Desai, *J. Chem. Soc.*, 1063 ; 1932.
[3] *J. Chem. Soc.*, **121**, 2754 ; 1922.

Effects Produced on Rats by Synthetic Androsteron (Male Sex Hormone)

AT the request of Prof. Ruzicka, I undertook the experimental investigation on male and female rats of the biological properties of androsteron and some of his other allied synthetic preparations. The following are the first results with androsteron.

(1) Androsteron contains both one rat unit of "Comb growth activity" and one rat unit of "whole male sexual activity" (as defined by me[1]) in from 175 to 179 γ, the rat unit approximating to, if not being equal to, the capon unit (Butenandt and Tscherning[2] and Ruzicka and co-workers[3]).

(2) The effect of androsteron in increasing the weight of the atrophied prostate of castrated rats is nearly directly proportional to the dose with doses of from 0·2 mgm. to 0·9 mgm., after which dose the curve flattens.

(3) The daily dose of 1·8 mgm. of androsteron injected into castrated rats for 21 days caused an increase in weight of the atrophied prostate by about 800 per cent and of the seminal vesicles by about 500 per cent, of the penis by about 200 per cent and of the preputial glands by about 180 per cent.

(4) In castrated males and in ovariectomised females androsteron also caused the following changes : a return towards or to normal, a decrease in the weight of the adrenals (hypertrophied after castration) ; an increase in the weight of the liver, kidney and, in most males, to a slight extent the thyroid (which decreases after castration) ; the restoration of the normal rate of involution of the thymus ; an increase in the appetite and gain in body weight. Injections into castrated males also increased the weight of the heart (which is slightly decreased by castration).

In addition to these favourable results on the weight of the organs, histological investigation showed the absence of any toxic effect of androsteron in those organs of castrated rats the structure of which is not considerably changed by castration (liver, kidney and heart) and a return towards or to normal in those organs investigated the microscopical structure of which undergoes severe changes after castration (sexual organs, adrenals).

(5) Androsteron did not cause a return to normal (in weight or histologically) of the hypertrophied hypophysis of castrated males, nor did it produce œstrous in ovariectomised females even when injected in doses of 1·8 mgm. for 21 days. It also had no 'rejuvenating' effect on old male rats in the doses used (0·1 mgm. and 0·9 mgm. per day for 21 days).

Repetition of the assay with a second batch of androsteron and of some other experiments are in progress.

V. KORENCHEVSKY.
Lister Institute of Preventive Medicine,
London, S.W.1.

[1] *Biochem. J.*, **28**, 1498 ; 1934.
[2] Butenandt, A., and Tscherning, K., *Z. physiol. Chem.*, **229**, 179 ; 1934.
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A Useful Indicator for the Passage of Food through the Alimentary Tract of Animals

THE following method has been used at this laboratory to indicate the distribution of bacteria in the alimentary tract of the rabbit at various times after they had been given *per os*. It was found to work very satisfactorily and appears to have several advantages over the various colouring methods which have been used from time to time in observations on the passage of foods through the intestinal tract of domestic animals and birds.

The indicator is Lycopodium powder (used in pharmacy for covering pills) which is composed entirely of the spores of the staghorn moss, *Lycopodium clavatum*. The powder requires to be placed in slightly soapy water before it can be wetted, but this is not necessary if it is to be mixed with food. Lycopodium spores are easily recognisable under the microscope, but their chief merit as an indicator for the passage of food through the alimentary tract lies in the ease with which they can be recovered from the ingesta by means of the ordinary sugar floatation technique, as used for the recovery of nematode eggs from the fæces. It also has the advantage that a count of the spores can be made by any of the methods used for counting nematode eggs in fæces, and fairly accurate information so obtained post-mortem on the relative amounts of the test dose in various parts of the alimentary tract.

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Oxygen Consumption of the Cockroach in Relation to Moulting

DURING experiments on the oxygen consumption of *Blatella germanica*, it was observed that one specimen which was used on the day of its last moult, when it was still pale in colour, had a respiratory rate about 50 per cent higher than the normal. Experiments were accordingly undertaken in which the rate of oxygen consumption of the last

stage nymphs of a related species (*Blatta orientalis*) was measured at intervals until after the animals had moulted and become adult. The Barcroft apparatus was used at 25° C.[1]

	Number of observations.	Average oxygen consumption in mgm./gm./day, and standard error.
11th to 2nd weeks before the moult	29	9·0±0·18
Day of moult and 3 days following	21	14·3±0·37
2nd to 4th weeks after the moult	26	10·4±0·20

Average live weight per animal = 325 mgm.

Ten animals were used, but in only four cases was it possible to carry out an experiment on the actual day of the moult. In these cases the average oxygen consumption was 16·5 mgm. per gram live weight per day, and the rate fell after that day. The accompanying table summarises the results obtained, the figures for the week before and the last four days of the week after the moult being omitted in order that the difference between the periods chosen may be clearly seen. The difference between the rates 'during' (that is, day of moult and three days after) and after the moult is more than nine times the standard error of that difference. The difference between the rates before and after the moult is also quite significant.

Little is known about the internal histological and metabolic changes which take place during the post-embryonic development of exopterygote insects, though they are not nearly so great as the changes accompanying metamorphosis in the Endopterygota[2]. The external skeleton is, however, partly digested and partly shed and a new cuticle is laid down in its place[3]. It is to this process of moulting alone, in the absence of further information, that we may ascribe at present the additional oxygen consumed at this period.

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Feb. 8.

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Collision Frequency and Molecular Density in the F_1 Layer of the Ionosphere

RECENT measurements of the reflection coefficient of the ionosphere, for radio waves between 60 m. and 100 m., have led to a method of determining the collision frequency of electrons and molecules in the region where the ionisation density of the F_1 layer is a maximum. This is, roughly, at a height of some 200 km. above the earth's surface.

The pulse technique of Breit and Tuve was used, and simultaneous records were made of the equivalent height and reflection coefficient of the ionised regions. At certain times the equivalent height rose rapidly to a great value and then decreased again. Simultaneously, the echo intensity decreased to a minimum and then increased again, the minimum intensity corresponding with the maximum equivalent height.

An example is shown in Fig. 1. Such results are interpreted on the supposition that, at the time of maximum equivalent height, the actual frequency ν of the emitted waves is very close to the maximum critical frequency ν_0 of the F_1 region. In such conditions, the extra attenuation shown by the dip in the curve (2) is caused by the collision of electrons with molecules which occur in the neighbourhood of the F_1 ionic density maximum.

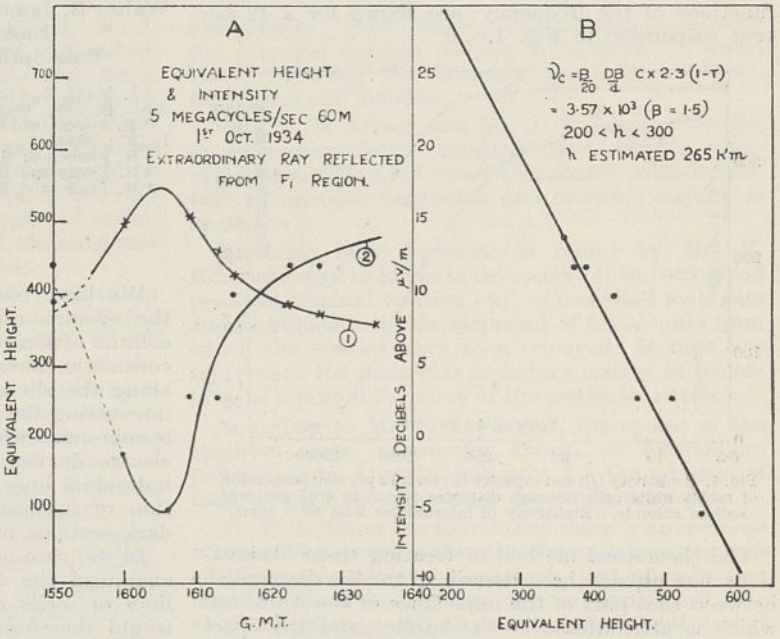

FIG. 1.

The reflection coefficient, in this case, can be shown to be $e^{-t/\beta\tau_c}$ for the ordinary ray, and $e^{-t/\beta\tau_c(1-\tau)}$ for the extraordinary ray, and this is true for vertical incidence whatever the direction of the terrestrial magnetic field. τ_c is the mean time between successive collisions of an electron with the molecules of the atmosphere, $\tau = eH/2\pi m\nu$, and β is a constant[1] equal to $\frac{3}{2}$.

Thus there should be a linear relation between the log intensity and equivalent height (proportional to the delay time t). This is illustrated in Fig. 1, *B*. The slope of this line will then give the collision frequency ν_c. In the example illustrated in Fig. 1, $\nu_c = 3{\cdot}6 \times 10^3$ for an estimated height of 265 km.

The determination of ν_c involves no other quantities than the relative intensities and delay time t, which can be measured with a fair degree of accuracy.

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[1] D Burnett, *Proc. Camb. Phil. Soc.*, **27**, (pt. 4), 578, Oct. 1931.

Electric Impedance of Suspensions of Leucocytes

CONCENTRATED suspensions of rabbit white cells were prepared by the method described by Mudd, Lucké, McCutcheon and Strumia[1]. When obtained by this method, about 95 per cent of the cells are polymorphs. Microscopic examination and measurement of respiration showed that the cells were in a normal condition. The impedance measurements were made at 21·4° C. Suspensions having volume concentrations from 10 to 42 per cent, in buffered 0·95 per cent sodium chloride, were used and the resistivity R (ohm−cm.) and parallel capacity C (mμ F/cm.) were determined from 0·25 to 16,000 kilocycles per sec.[2,3] The values of R and C, as functions of the frequency, are shown for a 42 per cent suspension in Fig. 1.

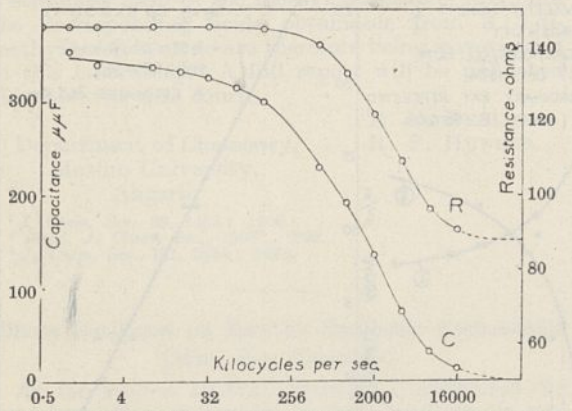

FIG. 1. Resistivity (R) and capacity (C) for a 42 per cent suspension of rabbit white cells (average diameter 10·5μ) in 0·95 per cent sodium chloride. Resistivity of intercellular fluid 69·0 ohms.

The theoretical method of treating these observations has already been described[2,3]. We distinguish between that part of the impedance of the white cell which is attributable to the surface and that part attributable to the interior. At low frequencies only the former part is effective and from the (approximate) constancy of C and R, at these frequencies, it is concluded that the impedance at the surface is due to the presence of a poorly conducting membrane which acts as a static condenser. By the same criteria, the presence of such a membrane at the surface of the erythrocyte and of the yeast cell has previously been established[2,3,4]. The capacity per sq. cm. of surface of the white cell can be calculated to be $1·0 \pm 0·1$μF/cm.^{2}. This value is the same as found for the surface membrane of the erythrocyte[3], within the limits of experimental error. With the rather arbitrary value of 3 for the dielectric constant of the membrane, this capacity corresponds to a thickness of 27×10^{-8} cm.

From experience with other cells[3,4], it is likely that C and R increase slightly at the lowest frequencies. The theoretical significance of this increase as related to the ionic permeability of the membrane has been discussed[3,4]. Unfortunately, due to the rapid settling of the white cells, this increase cannot be accurately measured here, but it cannot be greatly different from that found for the red corpuscle. The decrease in C and R at about 128 kilocycles marks the point at which the interior of the cell makes its influence felt. The theoretical treatment is not sufficiently developed to allow us to recognise definitely any effects due to a polarisability of the membranes of the internal structures (nucleus, granules, etc.) but, within the present theoretical limitations, the impedance of the interior may be represented as a pure resistance, the specific value of which is calculated[2] to be 140 ± 10 ohm−cm. (21·4° C.). This value is, within experimental error, the same as found for the mammalian red corpuscle[5]. Since the organic matter content is nearly the same for these two types of cell, this agreement further strengthens the view that the impedance of the membrane of the internal structures in the white cell is negligible at the high frequencies for which the impedance of the internal fluid can accurately be determined.

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[1] S. Mudd, B. Lucké, M. McCutcheon and M. Strumia, *J. Exp. Med.*, **49**, 779; 1929.
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Moving Striations

WE have recently completed an investigation of the spectra of moving striations in the positive column of some glow discharges. Briefly, the method consists in forming an image of the positive column along the slit of a spectrograph, and covering and uncovering the latter by a mechanical shutter made synchronous with the moving striations by a photoelectric device. This arrangement gives spectra, the individual lines of which show a longitudinal variation of intensity corresponding to the bright and dark sections of the striations.

In the case of a discharge in pure argon, we have examined the dark period carefully for high series lines or series continua, and find them absent. It would therefore appear that recombination of ions and electrons in the gas phase is not important, and since it is known from work by Kenty[1] on argon that such recombination is only appreciable when the average electron energies fall below about 0·5 e.v., we conclude that the electron energies in the dark periods exceed this amount. This is confirmed by the measurements of Pupp[2] who, in a recent paper, has described the results of probe analysis of somewhat similar discharges and finds in the dark phase electron energies in excess of 1 e.v. Our optical results are also in accord with his electrical data in that we have found that when a trace of mercury is present, the mercury arc lines 5461 A. and 4358 A. (excitation potential 7·6 volts) persist strongly through the dark phase although argon lines (excitation potential greater than 12 volts) are, at best, extremely feeble there.

It is satisfactory to find that the optical and electrical studies of these still puzzling phenomena are mutually confirmatory to this extent.

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Accuracy of the Curie-Chéneveau Magnetic Balance

I HAVE read with interest, in NATURE of January 26, the letter by Messrs. Gray and Cruickshank concerning the Curie-Chéneveau magnetic balance. I may mention that I published a small work on this subject so long ago as 1914[1]. I found that measurements within one per cent could be made with the greatest ease, and that it was possible to increase the accuracy, with some care, up to a precision of some tenths of one per cent at least. The principal cause of errors and fluctuations were due to certain hysteresis effects in the moving parts of the apparatus (though non-magnetic) and especially in the damping device. My work was done with a somewhat improved type of apparatus due to P. Weiss and A. Piccard (unpublished, so far as I know).

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Points from Foregoing Letters

NEW experiments by Dr. C. D. Ellis and Mr. W. J. Henderson with radionitrogen (the first radioactive element prepared synthetically by M. and Mme. Joliot by the action of α-particles on boron) show that its half-life period is 11 minutes and not 14 minutes; it is thus identical with the half-life period of the radionitrogen obtained from carbon bombarded with protons. The difference previously believed to exist between the two types of radionitrogen has been adduced as proof of the existence of negatrons (negatively charged nuclei).

Mr. R. W. Gray's suggestion that whales can descend to 2,500 fathoms or more without suffering from caisson disease is disputed by Dr. F. D. Ommanney. He remarks that observations upon the behaviour of whales struck by harpoons offer little indication of their normal habits, and that descent even to two hundred fathoms would involve compression of the lungs to 1/35 of their usual volume.

When α-particles hit nuclei of the lighter elements, they do not scatter according to Rutherford's rule (effective for the heavier elements). Prof. G. Beck and Mr. L. H. Horsley submit a diagram illustrating the electrical barrier surrounding the nucleus, with its various 'energy levels' which are thought to determine the character of the scattering effect; they also indicate the type of scattering that has been observed with various light elements (Be^{9}, $B^{10, 11}$, C^{12}, F^{19}, Al^{27}). They infer that atoms of helium or lithium of mass 5 are unlikely to exist.

Dr. E. Gross and Mr. M. Vuks submit photographs of spectra of light scattered by crystals of benzene and naphthalene and by liquid benzene, supporting their previous interpretation of the 'wings' observed around the primary line of the spectra, as due in part to slow vibrations of the molecules and not to rotation. They point out that the central part of the 'wings', the intensity of which increases on heating, is characteristic of the liquid state.

The Wilson cloud chamber, in which condensed water vapour renders visible the tracks of electrified particles, has been one of the most useful instruments in studying subatomic phenomena. Mr. P. Kipfer has constructed a small high-pressure Wilson chamber in which gases compressed up to 100 atmospheres can be used. This should increase the probability of atomic collision and reduce the time necessary for observations and the expense of taking a large number of photographs.

Mr. J. W. Dunne has put forward the view that time is polydimensional; he considers a succession of 'time within time', and is led by those considerations to assume the existence of freewill and immortality. Prof. Dingle, while viewing favourably the physical aspects of the hypothesis of 'serial time', considers Mr. Dunne's psychological interpretations not justified.

Prof. T. M. Lowry and Mr. J. T. Lemon describe an experiment which suggests that a higher oxide of nitrogen (NO_3) is formed transiently when a mixture of nitrogen pentoxide and ozonised oxygen is heated.

Synthetic male hormone is found by Dr. V. Korenchevsky to increase the weight of the atrophied prostate, seminal vesicles, etc., of castrated male rats and to influence the development of female rats from which the ovaries have been removed. It does not rejuvenate the male rats or induce œstrus in female rats, as reported for some of the testicular extracts.

According to Mr. E. L. Taylor, the spores of the staghorn moss, commonly known as lycopodium powder, form a useful indicator for the passage of food through the alimentary tract of animals.

Mr. D. L. Gunn has found that there is an increase of about 50 per cent in the rate of oxygen consumption of *Blatta orientalis*, the cockroach, just after its last moult. There is a similar rise in respiratory rate at the beginning and the end of the pupal period in insects which develop their wings inside the body until the pupal stage (Endopterygota).

From the relative intensities and delay time of radio pulses reflected from the F_1 electrically conducting layer of the upper atmosphere (about 200 km. high), Mr. T. L. Eckersley calculates the collision frequency of electrons and molecules in that layer.

The electrical resistance (impedance) to alternate currents, of concentrated suspension of white blood cells (from rabbits) has been determined by Dr. Hugo Fricke and Mr. Howard J. Curtis. From experimental results and from special theoretical considerations, they deduce that for low frequencies the resistance measured is that of the cell membrane, while at high frequencies the resistance measured is that of the internal fluid of the cells. The thickness of the cell membrane appears to be about 27 A., assuming an arbitrary value of 3 for its dialectic constant.

Messrs. Sloane and Minnis have obtained instantaneous photographs of the spectra of the moving striations which are a familiar feature of many commercial gas-discharge illuminating tubes. They find that the variations of the spectra through the bright and dark parts of the striations are in accord with what is known of the electrical properties of this form of discharge.

Research Items

Ethnology of Mysore. The Baron von Eichstedt, who himself has recently visited Mysore, contributes an introductory chapter on the racial history of Mysore in relation to that of India to "The Mysore Tribes and Castes", vol. 1 (Bangalore: Government Press). Mysore, like India as a whole, presents a fundamental contrast of open landscape and preponderantly mountainous jungle districts. Here also there is the same racial parallel: in the open country, settlements of a people of a progressive type, who are fair in the north of India and dark in the south and in certain refuge areas; and in the jungle districts primitive peoples who are fair in the western areas and dark in the eastern. Thus in India as a whole there are three main groups, each subdivided into two:—(1) The racially primitive peoples of the jungle region, the Ancient-Indians or Weddid racial group, divided into the Gondid race, a dark-brown curly (wide) haired people with totemistic mattock-using culture; and the Malid type, a black-brown curly (narrow) haired people with originally ancient culture. (2) The racially mixed group Black-Indians, or Melanids, divided into the black-brown progressive people in the most southern plains with strong foreign matriarchy, the southern Melanids; and a black-brown primitive people of the northern Deccan with strong foreign (totemistic and matriarchal) influence, the Kolid type. (3) The racial progressive people of the open regions, New Indians or Indid group, divided into a gracile-brown people with enforced patriarchy—Gracile-Indid race; and a coarser light brown people with possible original patriarchal herdmanship—the North Indid type. So in Mysore is found the best preserved and most primitive of the primitive inhabitants of India, the Malids, with the later Gondids intruding, pre-Aryan North Indid herdsmen in the remnant of the Todas and traces of North-Indids all over the State, mixing with the older and partly younger intruders foreign to India, Palæo-mongolids, 'West-Brachids' and orientaloid Mohammedans.

Yao Education. In a study of the Yao tribe of Nyasaland, by Father Benno Heckel (University of London Institute of Education: Studies and Reports, No. 4, Oxford University Press. Pp. 53. 2*s*. net) an account is given of the initiation of boys and girls. These ceremonies represent a real fountain of life and are the basis of continued tribal existence. Information is difficult to obtain, as the greatest secrecy about them is maintained, and any violation would entail death. Initiation of boys takes place at 14–17 years of age. Each candidate is assisted by a patron, an elder man, who acts as tutor or instructor, and there is a leader, the 'Tail-bearer', who carries a zebra tail as a mark of distinction. The period of the initiation course is prolonged to three or four months, during the whole of which the novices must live in the place of initiation and submit to a severe discipline. They bathe before sunrise and are thereafter kept hard at work for the whole day. Ineradicable habits and perfect knowledge are inculcated by songs, hymns, dances and games. The course does not consist of abstract instruction, but of a pleasing and concrete form of education up to the standard of knowledge and practice of adult life. Sanctions corresponding to duties are taught by practical demonstration; for example, if punishment is death by a lion, on a very dark night the roaring of a lion nearby will be heard and continue until the novices promise fidelity. They are taught standards of politeness, hospitality and friendship, the history of the tribe and its phratries, tribal laws, rules of marriage, the names of the plants and animals they are not allowed to eat, the duties of marriage and conjugal intercourse and the like. After a ceremonial return to the village, the novices are considered to be adult, and undertake men's duties.

Geographical Variation in Number of Teeth. The Cyprinid family of fishes includes some two hundred genera distributed in all parts of the world except South America, Australia and Madagascar. The rows of pharyngeal teeth are distributed among these genera in numbers which have a clear geographical significance (V. D. Vladykov, *Copeia*, 1934, p. 134). Thus genera with three rows of pharyngeal teeth do not occur in America and one-row genera somewhat exceed in number two-row genera. In Europe about 9 per cent of the genera have three rows, and two rows are dominant. At the other extreme, Africa has only two one-row species and 90 per cent have three rows, species been taken here for comparison since the genera are few (8). The accompanying table shows more clearly than description could show the relationships of the numbers:

Regions	Percentage Nos. of rows of pharyngeal teeth			Total No. of genera
	1	2	3	
North America	46·0	40·5	—	37
Europe	41·0	50·0	9·0	22
East Asia	23·0	23·0	49·0	57
India	8·0	12·0	68·0	25
Africa (species)	0·6	3·0	90·0	262 species

Systematics of the Penæids. Mr. Martin David Burkenroad discusses the littoral and sub-littoral penæids of the world, the present studies being mainly centred about American Penæinæ and Eusicyoninæ ("Littoral Penaeidae chiefly from the Bingham Oceanographic Collection, with a Revision of *Penaeopsis* and Description of two New Genera and Eleven new American Species" (*Bull. Bingham Oceanographic Coll.*, 4, Sept. 1934). In further work he proposes to continue this revision to complete a monographic account of the group. The tropical west coast of America is found to be extraordinarily rich in penæids, ten of the eleven new species described in the present paper coming from the Pacific, one belonging to a new genus; and much that is new and interesting is shown in the distribution of the various species. A systematic revision was evidently much needed and the present account is full of careful comparative work based on the examination of material from different sources, necessitating certain alterations in the existing classification. Special attention is given to the petasma, for which a generally applicable terminology is prepared, and the internal morphology, homologies and probable mode of operation of the thelycum in a number of the Penæinæ are described, including a discussion of certain methods of separation of the entrance and exit to the sperm receptacles; a series of excellent text figures of these structures is given.

Amœboid Cells in Invertebrates. A useful summary of the different kinds of amœbocytes and allied cells in invertebrates has been prepared by Isabel Haughton (*J. Roy. Micro. Soc.*, 54, Pt. 4, Dec. 1934). The blood cells of invertebrates show types of stages corresponding with those found in vertebrates, but in addition are others, such as the adipo-spherical cells (spherical cells filled with fat globules and protein spheres) found free in the cœlomic fluid of Annelida or aggregated into a tissue in insects, which do not correspond with any cells found in vertebrates. Amœboid movement is common in the leucocytes of invertebrates, but the property of thigmotaxis—the spreading of the corpuscles when they come into contact with a foreign body—which is irreversible, has often been mistaken for amœboid movement which is reversible, for the pseudopodia can be withdrawn. The leucocytes often exhibit phagocytosis, and they play a large part in digestion and excretion, especially in the bivalve molluscs, in which they ingest food material, as they lie between the epithelial cells in the wall of the stomach, and transport it thence to the connective tissue where they digest the food. Coagulation of blood is found among invertebrates only in some Crustacea; the formation of clots in other invertebrates is due to agglutination or clumping of the blood cells. In the examples studied, phagocytes are widely distributed throughout the body, especially in connexion with the digestive organs and in the connective tissue. Lymph glands have been demonstrated only in very few invertebrates and therefore the origin of the amœbocytes and blood cells is obscure. Mitosis has been observed in the small hyaline cells, and the general impression is that from this the other types are developed by acquisition of granules.

Development of a Braconid Parasite. Mr. P. M. Glover, of the Indian Lac Research Institute, Ranchi, India, has recently published a paper on the development of *Bracon tachardiæ*, Cam. (*Bull. Entomol. Res.*, December 1934). The species in question is an ecto-parasite of the larva of the moth *Eublemma amabilis*, which is an important predator on the lac insect. The first five larval instars of *Bracon* are described and certain structures are figured in some detail, while an analysis of their growth phases is given. It is found that head-width is a safe indication of a given instar since extremes rarely occur: the widths calculated on Dyar's principle also approximate sufficiently closely to the observed widths to preclude the overlooking of an ecdysis. The length of the mandible is identical in a given instar and its exuviæ, and allows of their grouping, particularly if averages be taken: the range for a given instar is wide, but the extremes do not overlap. The factors for increase of head-width and mandible-length are fairly similar, falling near to 1·26. The growth of the body of the larva from instar to instar is independent of head growth, larvæ increasing in weight and volume by a figure lying between 3 and 4 times, from instar to instar, and closely approaches the theoretical figure for volume (3·6). It is suggested that similar observations may be true for other ectoparasitic Braconidæ.

Bihar Earthquake of 1934. At the meeting of the Geological Society of London on February 6, a lecture on the Bihar-Nepal earthquake of January 15, 1934, was given by Dr. J. A. Dunn, who directed the study of the earthquake on behalf of the Geological Survey of India. The fracturing that caused the earthquake lay beneath the deep alluvium of the Gangetic plains. The direction of oscillation was usually parallel to the trend of the epicentral region, not radial to it, suggesting that the initial movement was principally along the strike of the fault. The total duration of the earthquake was about five minutes, most of the damage being done during the latter half of the disturbance. Surface undulations, 6–12 ft. long and perhaps 6 in. high, were seen even at a distance of 200 miles from the epicentral area. An interesting feature of the map of isoseismal lines is the occurrence of alternating zones of less and greater intensity outwards from the central tract, due probably to displacements along secondary lines of weakness. Within the central isoseismals lay a belt, 190 miles long, in which tilting of buildings and collapse with subsidence of the ground was more marked than actual destruction by vibration. The belt probably lay over that part of the fracture along which differential movement was greatest.

Soil Survey in Berkshire. The University of Reading has already published a soil survey of the county of Berkshire, but it was clear that an intensive study of certain areas with the use of more modern methods was desirable if an explanation was to be obtained as to why fruit-growing had been able to establish itself as an important industry in a certain part of the Vale of the White Horse. A detailed survey of this area has, therefore, been recently carried out by Dr. F. F. Kay and the results published by the University of Reading as Bulletin 48, "A Soil Survey of the Eastern Portion of the Vale of the White Horse". The district was found to fall into four natural areas, which are described in detail, and the soils, classified on the basis of their soil profile characteristics, grouped into twenty soil series, the appropriate weed flora being described for each. The calcareous nature of the majority of the soils necessitated the use of certain modifications of the usual methods of analysis especially in connexion with mechanical analyses and the determination of exchangeable potassium. High figures for potassium saturation were correlated with a siliceous type of clay and free drainage conditions, and a classification of base-saturated calcareous soils is suggested on the basis of the nature of the clay fraction. The most useful fruit soils were characterised by free drainage conditions, a high degree of potassium saturation and a siliceous type of clay. Excellent cherries could be produced on the Blewbury and Harwell series and very good quality apples grown on the Hendred and Harwell series. Potash manuring was shown to be essential on the light loams of the Corallian.

Dust in the Air. The January issue of the *Review of Scientific Instruments* contains a description of an instrument for taking direct photographs of dust in the air, devised by Messrs. L. H. Ott and J. B. Ficklen, of the Sloan Physics Laboratory of Yale. The usual methods of collecting the dust in water or allowing it to settle on a plate of glass, or making the air containing it impinge on a glass surface to which the dust adheres, they consider unsatisfactory, and have found that by using strong illumination they can photograph the dust particles. The air to be tested is drawn into the lower portion of a vertical tube which is then closed. The upper part contains a camera directed downwards and focused on a thin horizontal band of the air, which can be strongly

illuminated for an instant through a window in the side of the tube by a photographic flash-lamp outside the tube. A supersensitive panchromatic film is used and the whole apparatus weighs only 5 lb. A photograph of chalk dust particles which vary in size from 1×10^{-3} to 5×10^{-3} cm. is reproduced.

Theory of the Auger Effect. E. H. S. Burhop (*Proc. Roy. Soc.*, A, Feb. 1) has investigated theoretically the radiationless transformation by which an atom ionised in, say, the *K* shell, may re-arrange itself by an electron falling in from another shell and giving up its excess energy to another electron, which is expelled from the atom. The quantum mechanical approach is similar to that used by Hulme to consider the internal conversion of γ-rays. Hydrogen-like wave functions were used to represent the two electrons, the nucleus being supposed to be screened according to Slater's rules. The probability of transition between the initial state and the final state (one electron in the *K* shell and one electron unquantised) is calculated by means of a formula of Dirac, an allowance being made for the fact that either of two electrons may fall into the *K* shell, the other being ejected. There is no means of distinguishing these processes experimentally. The intensity of the *K* radiation is also calculated so that the probability of radiative and radiationless transformation may be compared. Numerical calculations are carried out and compared with experimental results. The variation of the internal conversion with atomic number is satisfactorily given, and the variation of intensity among different transitions in the atom is also obtained in agreement with experiment.

Transmutation of Sodium by Deutons. E. O. Lawrence (*Phys. Rev.*, Jan. 1) has made an extensive study of the nuclear reactions produced in sodium by H^{2+} ions having energies of 1·7 million volts. The following transmutations take place:

The production of radio-sodium

$$_{11}Na^{23} + {}_1D^2 \rightarrow {}_{11}Na^{24} + {}_1H^1,$$

followed by

$$_{11}Na^{24} \rightarrow {}_{12}Mg^{24} + e;$$

alternatively

$$_{11}Na^{23} + {}_1D^2 \rightarrow {}_{12}Mg^{24} + {}_0n^1,$$

and possibly

$$_{11}Na^{23} + {}_1D^2 \rightarrow {}_{10}Ne^{21} + {}_2He^4.$$

The radio-sodium was produced in considerable quantity (equivalent to about ⅓ mgm. radium) and it is suggested that it may be produced in this way for biological work. Its decay period was measured with an electroscope, and gave a value of 15·5 hours, similar to that of the radio-sodium obtained by Fermi by a different process. Absorption measurements were made on the β-rays, giving a probable maximum energy of about 1·2 mv. About one γ-ray was found to accompany each β-transformation, the γ-rays being probably monochromatic and of energy of the order of 5½ mv. These γ-rays should be valuable, for example, in the study of electron-positron pair production. The protons accompanying the activation of sodium were identified and their energy distribution studied. The Gamow theory was found to account for the variation of radio-sodium yield with bombarding potential. Neutrons and α-particles corresponding to the alternative reactions above were also found.

NO_3F. By the action of fluorine on moderately concentrated nitric acid, an explosive colourless gas of the formula NO_3F is produced (G. H. Cady, *J. Amer. Chem. Soc.*, **56**, 2635; 1934). The vapour density is about 82, the boiling point about − 42°. The gas is fairly stable at room temperature, but explodes on heating. It has an irritating odour. NO_3F is moderately soluble in water, with which it reacts slowly, liberating oxygen. It liberates iodine from potassium iodide, forming a nitrate and fluoride, and reacts with potassium hydroxide according to the equation $NO_3F + 2OH' = \frac{1}{2}O_2 + F' + NO_3' + H_2O$.

Mechanism of the Biological Oxidation of Ammonia. Messrs. Gopala Rao and K. M. Pandalai, writing from the chemical laboratories of the Andhra University, Waltair, India, state that they have investigated the possibility of the formation of hydroxylamine as an intermediate product in the oxidation of ammonia by nitrifying bacteria. Various tests for hydroxylamine were employed, but always with negative results. There was no difficulty in detecting its presence after addition of small quantities to the cultures. The positive results recorded by Mumford (1914) are attributed to the use of impure cultures, and the confirmation given by Mazé (1921), Kluyver and Donker (1926) and Fowler (1934) is not based on experimental evidence.

A New Cold-Cathode Amplifying Valve. A paper entitled "An Electron Multiplier" describing a new type of cold-cathode amplifying valve developed by P. T. Farnsworth of the Television Laboratories, Ltd., U.S.A., has recently been received (*Electronics*, August 1934). This new valve is a high-vacuum amplifier, which promises to find considerable application in television and other aspects of radio communication. The valve is cylindrical in shape and contains two cold cathodes, one at each end, with a metal ring anode mounted centrally between them. An electron produced photo-electrically is accelerated towards the anode, which is maintained at a high positive potential relative to the cathodes. A longitudinal magnetic field, produced by an external circuit, deflects the electrons, so that they miss the anode and strike the second cathode, where they produce secondary emission. The additional electrons so produced then travel in the reverse direction and the whole process is repeated. In order to ensure that the electrons arrive at the cathodes with sufficient velocity to dislodge further electrons, a potential difference of the order 25–90 volts at a frequency of 50 megacycles per second is applied between the two cathodes from a circuit tuned to this frequency. As the secondary emission process builds up, the current in this tuned circuit increases; and this current can be controlled by the external magnetic field and by the steady voltage applied to the anode. A maximum effect is obtained when this steady voltage is such that the transit time of the electrons between the cathodes is an odd multiple of half the period of the oscillations. It is stated that the actual current magnification obtained is enormous, since the electrons may make as many as a hundred complete transits of the tube, each time producing as many as six secondary electrons per original carrier. Different types of valves have been produced for amplification and oscillation, but much further research appears to be needed on the problem of making the valves uniform and efficient.

Foundation of the National Institute of Sciences of India

AT the twenty-first session of the Indian Science Congress, held at Bombay in the first week of January 1934, the General Committee considered the various suggestions regarding the foundation of an Indian Academy of Sciences that had been made during the previous year, and appointed a representative committee with the object of drafting a constitution to be laid before the next meeting of the Indian Science Congress, and to take necessary steps to bring the Academy into existence.

The General Committee was of opinion (Resolution II) that the principal purposes for which an Indian Academy of Sciences was desirable were :

(i) To act as a co-ordinating body between scientific societies in India, institutions, and Government scientific departments and services.

(ii) To act as a body of scientific workers of eminence to promote and safeguard the interests of men of science in India and also to act as a National Research Council.

(iii) To publish a *comptes rendus* of papers read before the Academy and also Memoirs and Transactions.

(iv) To promote and maintain a liaison between men of science and men of letters.

(v) To secure and manage funds and endowments for scientific research.

(vi) To do such other things as may be necessary for the promotion of science in India.

This Committee had an original membership of 24, which was increased during the year to 39 by co-opting members representing various interests, as was found desirable. The Committee held seven meetings and an emergency meeting. At these meetings the various points of view were considered very carefully and a scheme for the foundation of a National Institute of Sciences of India was evolved.

In accordance with the direction to take necessary steps to bring the Academy into existence, the Academy Committee had submitted its proposals to a hundred of the leading men of science of India representing all branches of science, and invited them to become its foundation fellows. An additional 25 scientific workers were invited to become foundation fellows on the vote of the first 100 foundation fellows, making a total of 125 foundation fellows. The scheme makes provision for the election of not more than ten ordinary fellows annually, in addition to a certain number of honorary fellows.

This scheme was placed before the General Committee of the Indian Science Congress held on January 3, 1935, and adopted unanimously, together with a recommendation that twenty-five ordinary fellows be elected in the first year instead of ten. The proposal for adoption was moved by Dr. L. L. Fermor on behalf of the Academy Committee and was supported by representatives of the General Committee (Prof. P. N. Ghosh), Asiatic Society of Bengal (Sir U. N. Brahmachari), U.P. Academy of Sciences (Prof. K. N. Bahl) and Indian Academy of Sciences (Prof. B. Venkatesachar).

At the inaugural meeting, which was held on January 7, 1935, Dr. J. H. Hutton, as president of the Indian Science Congress, requested His Excellency Sir John Anderson, Governor of Bengal, to inaugurate the National Institute of Sciences of India.

In inaugurating the first session of the National Institute of Sciences of India, His Excellency Sir John Anderson referred to the various stages in the progressive organisation of modern science in India. He said that the foundation of a society of varied and comprehensive character, such as the Asiatic Society of Bengal, was the first stage, followed three quarters of a century later by the foundation of universities and specialist scientific services. The third stage was reached half a century later with the foundation of the Indian Science Congress holding annual meetings of individual scientific workers, leading, after the lapse of a quarter of a century, to the foundation of a central and all-India co-ordinating body, the National Institute of Sciences of India, embracing all modern scientific research in India.

His Excellency's speech was followed by the presidential address of Dr. L. L. Fermor, F.R.S., who has been elected its first president. Dr. Fermor traced the history of the development of scientific research in India in the twentieth century, leading up to the formation of the National Institute. He further explained the co-ordinating functions of the National Institute *vis-à-vis* the Academies of Sciences in India, and the method by which it is proposed to ensure their co-operation. The objects of the National Institute are stated to be "the promotion of natural knowledge in India including its practical application to problems of national welfare", which is indeed a very comprehensive programme.

The Institute will act as a body of men of science of eminence to promote and safeguard the interests of scientific workers of India. By the publication of a *comptes rendus* containing summaries of the papers read before all Academies of Science in India and by the preparation of an annual report on the progress of science in India in all its branches, it will focus attention on the research work being done in the country and indicate the lines in which progress is desired.

The National Institute will also be prepared to act through properly constituted National Committees in which other learned academies and societies will be associated, and as the National Research Council of India, for undertaking such scientific work of national and international importance as required by the public and by Government. The National Institute and the Academies of Science in India will have mutually complementary functions and will co-operate with each other as independent organisations. The National Institute will thus occupy a very important place in the scientific life of India, and its activities will be a potent factor in India's national progress.

The inaugural meeting was followed by the first ordinary general meeting of the National Institute, which was held on January 8, 1935, in the rooms of the Asiatic Society of Bengal. This meeting was attended by thirty-seven foundation fellows and a large number of visitors from among the members of the Indian Science Congress. The result of the ballot for the election of the first council of the National Institute was announced at this meeting. The Council for 1935 is constituted as follows :

President : Dr. L. L. Fermor, director of the Geological Survey of India, Indian Museum, Calcutta.

Vice-Presidents : Brigadier H. J. Couchman, Surveyor-General of India, Calcutta ; Prof. B. Sahni, professor of botany, University of Lucknow.

Treasurer : Dr. S. L. Hora, assistant superintendent, Zoological Survey of India, Indian Museum, Calcutta.

Foreign Secretary : Prof. M. N. Saha, professor of physics, University of Allahabad.

Secretaries : Prof. S. P. Agharkar, Ghose professor of botany, University of Calcutta. Dr. A. M. Heron, superintendent of the Geological Survey of India, Indian Museum, Calcutta.

Members of Council : Mr. M. Afzal Hussain, principal of the Punjab Agricultural College, Lyallpur, Punjab ; Mr. T. P. Bhaskara Shastri, director of the Nizamiah Observatory, Begumpet, Hyderabad, Deccan ; Dr. S. S. Bhatnagar, university professor of chemistry and director of the University Chemical Laboratories, Lahore ; Mr. B. C. Burt, agricultural expert, Imperial Council of Agricultural Research, New Delhi (and Simla) ; Prof. J. C. Ghosh, head of the Department of Chemistry, University of Dacca, Ramna, Dacca ; Dr. F. H. Gravely, superintendent of the Government Museum, Museum House, Egmore, Madras ; Lieut.-Col. R. Knowles, professor of protozoology, School of Tropical Medicine, Calcutta ; Dr. K. S. Krishnan, Mahendralal Sircar professor of physics, Indian Association for the Cultivation of Science, 210 Bow Bazar Street, Calcutta ; Prof. S. K. Mitra, Khaira professor of physics, University of Calcutta, University College of Science, Calcutta ; Prof. J. N. Mukherjee, Khaira professor of chemistry, University of Calcutta, University College of Science, Calcutta ; Dr. C. W. B. Normand, director-general of observatories, Meteorological Office, Poona 5 ; Prof. Ganesh Prasad, Hardinge professor of higher mathematics, University of Calcutta ; Dr. Baini Prasad, director of the Zoological Survey of India, Indian Museum, Calcutta ; Sir C. V. Raman, director of the Indian Institute of Science, Bangalore ; Lieut.-Col. S. S. Sokhey, director of the Haffkine Institute, Parel, Bombay ; Lieut.-Col. J. Taylor, director of the Central Research Institute, Kasauli (Simla Hills) ; Mr. S. C. Trevor, president of the Imperial Forest Research Institute, Dehra Dun ; Mr. F. Ware, director of the Imperial Institute of Veterinary Research, Muktesar.

The following representatives, in each case a vice-president and a member of council, of scientific bodies in India were also appointed :

Asiatic Society of Bengal : Sir U. N. Brahmachari, Medical College Hospital (Retired) ; Mr. C. C. Calder, director of the Botanical Survey of India and superintendent of the Royal Botanic Gardens, Sibpur, Howrah.

U.P. Academy of Sciences : Prof. K. N. Bahl, professor of zoology, University of Lucknow ; Prof. A. C. Banerji, professor of mathematics, University of Allahabad.

Indian Academy of Sciences : Prof. B. K. Singh, professor of chemistry, Ravenshaw College, Cuttack ; Dr. K. V. A. Krishnan, bacteriological research officer, School of Tropical Medicine, Calcutta.

Indian Science Congress Association : Dr. J. H. Hutton, deputy commissioner, Naga Hills, Kohima, Assam ; Mr. W. D. West, assistant superintendent of the Geological Survey of India, Indian Museum, Calcutta.

At this first ordinary meeting, eleven papers were read, the titles of which are given below :

(i) "Synopsis of the Pre-Vindhyan Geology of Rajputana" by Dr. A. M. Heron.

(ii) "Physiology, Bionomics and Evolution of the Air-Breathing Fishes of India" by Dr. S. L. Hora.

(iii) "Problems of the Solar Corona" by Prof. M. N. Saha.

(iv) "Ionospheric Height Measurements at Allahabad" by Mr. G. R. Toshniwal (communicated by Prof. M. N. Saha).

(v) "On the Electron Theory of Metals" by Dr. R. C. Majumdar, University of Lahore (communicated by Prof. M. N. Saha).

(vi) "On Symmetrical Space with Minimum Rate of Expansion" by Prof. N. R. Sen.

(vii) "New Facts regarding Infection of *Citrus colletotrichum gleosporoides*" by Dr. H. Chaudhuri, Lahore.

(viii) "Synthetic Enzyme" by Prof. H. K. Sen and Mr. Sobhanlal Banerji.

(ix) "On the Question of the Expansibility of Zero in the Series of Legendre Functions having Non-integral Parameters" by Prof. Ganesh Prasad.

(x) "On the Cataphoretic Speed and Inorganic Colloids" by Prof. J. N. Mukherjee, Mr. S. G. Chaudhuri and Mr. B. N. Ghosh.

(xi) "Mon and Munda in India and Beyond" by Dr. J. H. Hutton.

It may be confidently expected that the National Institute of Sciences of India will play an increasingly important part in the development of scientific research in India.

Mechanical Testing of Timber

IN September 1928 a committee was appointed by the Committee of the Privy Council for Scientific and Industrial Research to report "On the Mechanical Testing of Timber". This report has now been issued (London : H.M. Stationery Office, 1934). The Committee had its origin as a consequence of work done during the War, in connexion mainly with the design of aircraft, when the testing of timber became a matter of particular importance ; as was shown by the amazing development in aircraft construction and reliability. In 1920, a report was published under the auspices of the Aeronautical Research Committee "On the Materials of Construction used in Aircraft and Aircraft Engines", by Lieut.-Col. C. F. Jenkin, professor of engineering science in the University of Oxford. Prof. Jenkin had served as director of the Materials Section of the Technical Department, dealing with the production of aircraft under the Ministry of Munitions. Chap. x of the report dealt with the mechanical properties of timber in a comprehensive manner.

The Committee appointed in 1928 consisted of the late Sir Alfred Ewing (chairman), Prof. C. F. Jenkin, Prof. A. Robertson and Messrs. W. D. Douglas and C. J. Chaplin. The terms of reference were taken as implying "an unrestricted review of the testing of timber for strength and elasticity". This necessarily included consideration in detail of the methods of testing in use at the Forest Products Research Laboratory, Princes Risborough. Various investigations were carried out at this Laboratory during the course of the investigation. Other important experiments were carried out for the Committee by Prof. E. G. Coker in his laboratory at University

College, London, and by Mr. Douglas at the Royal Aircraft Establishment.

The history of the development of the mechanical testing of timbers is not without interest. The system followed in most laboratories is practically that devised by the United States Forestry Service, and is the outcome of a scheme proposed in 1891 by Mr. B. S. Fernow, then chief of the U.S. Forest Service. At a somewhat earlier date, the Prussian Government had laid down a basis for timber testing; and Fernow stated that the two methods were practically the same, except that in the United States "the need of practically applicable results has been kept in the foreground". The American system received a further development about 1902 when it was adopted in the newly-established Forest Products Laboratory at Madison, Wisconsin. In 1920, the U.S. Forest Service requested the American Society for Testing Materials to consider the standardising of timber tests, and the methods then formulated were adopted in 1925 by the newly instituted British Forest Products Research Laboratory. Before this, they had been substantially accepted in the procedure of the Forest Products Laboratories in Canada, India and New Zealand. They have also been adopted by Australia, the Federated Malay States and to some extent by Sweden, Poland and Japan.

The Committee points out that its investigations are only concerned with mechanical tests on small 'clear' specimens of timber—that is to say, specimens which are free from knots, shakes or other defects. The work of forest products laboratories, it realises, is concerned with both large and small specimens.

It is impossible here to follow the Committee through the investigation work carried out which enables it to form its conclusions. It should be mentioned that the testing methods in use at the time had been adopted as standard ones and included the British standard specification for methods of testing small clear specimens of timber (No. 373—1929) issued by the British Standards Institution. Although from a practical point of view the tests were the best that could have been devised with the knowledge then available, it was generally felt that several of the methods commonly employed were open to criticism from a scientific point of view. An opinion in this sense expressed to the Department in 1928 by Prof. C. F. Jenkin led to the appointment of the Committee which has presented the report now before us.

The Committee's Report concludes with the following: "Broadly speaking the several purposes for which mechanical tests for timber are, or may be, undertaken may be classified as follows:—

I. Tests which regard timber from the point of view of the physicist as a material for scientific examination, apart from any intended practical application.

II. Tests which regard timber from the point of view of the engineer as part of a structure that is to be designed to carry certain loads or perform other specified duties.

III. Tests appropriate for the grading of a number of timbers or for judging of their conformity to a given specification."

"Much, but by no means all, of the work of a Forest Products Laboratory falls within the third category and may properly involve methods of testing which would not be appropriate for the first purpose or even the second. On the other hand, tests suitable for the first purpose, or the second, are often attended by difficulties and restrictions which would put them out of court as matters of routine. It is clearly desirable that, subject to these considerations, the interpretation of all tests should be intelligible and their results definite; but it should be recognised that in providing for the various purposes here roughly indicated, tests of widely different character must be contemplated and they will be subject to different canons of criticism."

Timber testing has a growing value in the world of to-day, and the work of this Committee will be received with high approval and gratitude by research centres throughout the world.

National Inland Water Survey

THE paper on "National Inland Water Survey" by Dr. Brysson Cunningham, read at the meeting of the Royal Geographical Society on March 11, set out the scope of a survey required, not merely to serve the responsibilities of the Ministry of Health in regard to water supply for domestic purposes, but also to meet the needs of industry and commerce, the possible development of hydro-electric motive power, the requirements of irrigation, fisheries and navigation, the drainage of low-lying lands, the prevention of floods and other equally important matters. It defined a national survey, in the technical and only satisfactory sense of the word, as a comprehensive and accurate measurement and complete registration, so far as may be practicable, of all the water to be found in a country, whether contained in lakes, rivers, streams, wells, artificial reservoirs, or subterranean strata and cavities. A survey, it stated, should be regarded as a purely scientific undertaking, necessitating special technical knowledge and supervision, and in order to ensure its absolute impartiality, where so many different and possibly conflicting purposes are to be served, it should, as recommended by the Committee of the British Association, be conducted by an organisation "independent of any interest in the administration, control or use of water", such an organisation being available in the Department of Scientific and Industrial Research, which is equipped for work of this kind and possesses the essential scientific authority.

Proceeding to outline the programme of a survey, attention was directed, in connexion with rainfall, to the work of the British Rainfall Organization, which for a number of years past has carried out in an admirable manner the superintendence, collection and publication of data. Evaporation and soil absorption have not yet received the degree of attention needed for the purposes of a survey. It is also a regrettable fact that, up to the present time, there has been no department, or central organisation, constituted to deal with direct hydrological measurements of the amount of water actually derived from rainfall. While certain undertakings take gaugings for their own purposes, these are relatively few and the observations are not accessible by the public. The determination of run-off, that is, the bulk of the water which, following rainfall, escapes to the sea, constitutes therefore the greatest field of activity for

the survey. The records of the Thames Conservancy at Teddington Weir were instanced as one of the few cases of really effective river measurement. In England and Wales, much assistance in regard to stream gauging can be rendered by the Catchment Boards instituted under the Land Drainage Act, 1930.

The investigations of the British Association Committee were briefly described, and Dr. Cunningham then proceeded to review the methods and organisations adopted in certain other countries, namely, Canada, the United States, France, Germany, Switzerland and Italy. A number of lantern slides were exhibited illustrative of typical apparatus and installations in operation in the respective services. It was shown that in all these countries, in addition to rainfall measurement, great importance is attached to the consistent gauging and measurement of river- and stream-flow and to the publication of the results obtained, so as to be accessible by all who are interested.

Dr. Cunningham urged that it should be considered an essential part of the duty of those in charge of a survey to disseminate information and advice to local authorities and others engaged in the exploitation of water supplies and the control of floods. Finally, he said it would largely nullify the value of a survey if it were limited to the mere collection and filing of records and statistics. The keynote of the organisation should be active research.

Fungi of South Australia

A VERY useful series of handbooks on the flora and fauna of South Australia is prepared by the British Science Guild (South Australia Branch) and published by the Government of South Australia. The editorial committee shows that "there is an admitted lack of inexpensive but accurate books dealing with the plants and animals of South Australia, and it is felt that the absence of such has been a real handicap to young Australia, and so to the progress of Australian Science".

Handbooks on the general flora, mammals, fishes, the building of Australia and the succession of life, crustaceans, and reptiles and amphibians have already been published, while seaweeds, spiders, moths and butterflies, ants and birds are to be described in future volumes. The gratuitous services of recognised authorities on particular subjects have been obtained, whilst the Government of South Australia publishes the volumes at low prices. In spite of the serious depression through which South Australia has been passing, the Government has shown a commendable breadth of vision, and earned the gratitude of all scientific workers by continuing to publish this series.

Part 1 of the handbook on "Toadstools and Mushrooms" before us is by Prof. J. B. Cleland, chairman of the Handbooks Committee, and combines scientific exactitude with a simplicity of statement which should bring the knowledge within reach of any intelligent person. The introductory sections are particularly well written. They deal first with general questions of distribution and activity, and then with uses of fungi, poisoning, fungi and art, localities affected by different species, fungi and bush fires, larger fungi eaten by mammals, insects and other animals, luminescence of fungi, fairy rings, mechanical force exerted by fruiting bodies, methods of collection and preservation, and descriptions of special terms used in classification.

This takes up forty pages of closely-printed text, and the remaining 138 pages are devoted to a general classification of the higher fungi, and to a detailed classification of the Agaricaceæ. The system adopted for the latter combines the orderly, reasoned groupings set forth by Carleton Rea (in "British Basidiomycetæ") with the convenient detail of Claussen's subdivision by spore colour. This combination is used by the foremost students and teachers of mycology in Great Britain. Convenient keys to the species, as well as to the genera, are given.

Thirty-five photographs and drawings and six coloured plates enrich the text, and the price of five shillings is certainly extremely low for such a volume. Copies may be obtained from the Government Printer, North Terrace, Adelaide. British students of mycology can find a wealth of helpful description for many of our native species.

University and Educational Intelligence

CAMBRIDGE.—The Department of Scientific and Industrial Research has offered £2,300 for building and equipping an extension to the Low Temperature Research Station on its southern side. It is to be used in perpetuity for scientific research and in the first instance for research on problems arising out of the preservation and handling of foodstuffs. In the letter making this offer, it is stated that the Committee of Council has had under consideration the possibility of further extensions of the Station in the future, and that the only areas where such extensions appear to be practicable are at the southern end of the eastern side of the Station and at its north-eastern corner. Having regard to the developments which have taken place since the Station was first erected, the Committee considers it desirable that these two areas should be reserved against future needs.

The Smith's Prizes are awarded to H. G. Booker, of Christ's College, and L. Howarth, of Gonville and Caius College. Rayleigh Prizes are awarded to A. F. Devonshire, of Trinity Hall, T. E. Faulkner, of Gonville and Caius College, and F. Smithies, of St. John's College.

EDINBURGH.—The Senatus Academicus has resolved that the honorary degree of LL.D. be offered to the following, for conferment at the Graduation Ceremonial to be held on June 28 :—The Right Hon. Lord Bledisloe of Lydney, Governor-General and Commander-in-Chief of New Zealand ; Dr. Nicholas Murray Butler, president of Columbia University, New York ; Dr. James L. Garvin, editor of the *Observer* ; Mrs. M. M. Ogilvie Gordon, geologist, and vice-president of the International Council of Women ; Prof. J. Graham Kerr, regius professor of zoology in the University of Glasgow ; Prof. John Laird, regius professor of moral philosophy in the University of Aberdeen ; Sir George Macdonald, formerly secretary of the Scottish Education Department, archæologist, numismatist and historian ; Mr. John Donald Pollock, Surgeon-Commander R.N.V.R. medical service during the War ; Dr. A. N. Richards, professor of pharmacology in the University of Pennsylvania ; The Hon. Lord St. Vigeans, formerly chairman of the Scottish Land Court.

DR. L. FARKAS, who has been working in the Department of Colloidal Science in the University of Cambridge for the last two years, has been appointed lecturer in physical chemistry and head of the new Department of Physical Chemistry in the Hebrew University, Jerusalem, Palestine.

THE University of Durham inaugurated in October 1924 a Department of Science, and a statistical summary of the work accomplished in it in the ensuing ten years 1924–34 has now been published. Its educational work has been mainly for the benefit of prospective school teachers, these numbering 220 out of a total of 304 students who entered for undergraduate courses, but a substantial volume of original work has been done. Excluding book reviews and other miscellaneous publications, original papers, including books, published from the Department between October 1924 and December 1934, numbered 118, of which a large proportion, 49, were concerned with geology, local or general. A distribution of undergraduate students in 1934 among subjects assigns to physics 47, geology 39, mathematics 36, chemistry 34, botany 22 and geography 4.

Science News a Century Ago

Improvements in Iron Manufacture

On March 16, 1835, Dr. Clark read a paper "On the Application of the Hot Air Blast in the Manufacture of Cast Iron", to the Royal Society of Edinburgh. After giving a general account of the manufacture of cast iron, he said that the method first suggested by Mr. Neilson of Glasgow and tried at the Clyde Iron Works consisted of previously heating the air thrown into the blast furnace. The method was found to produce a vast saving of fuel and of flux. During the experiments made in 1830, the air was heated to 300° F. In 1831, Mr. Dixon of the Calder Iron Works thought of substituting raw coal for the coke which had hitherto been employed for fuel, at the same time heating the air to 600° F. The result was that three times as much iron was now made by the use of a given weight of coal as formerly.

Geology of the Cordillera

On March 11, 1835, H.M.S. *Beagle* anchored again at Valparaiso, and a few days later Darwin set out to cross the Andes to Mendoza by the Portillo Pass. In his account of the journey, he recorded on March 19, 1835: "All the main valleys in the Cordillera are characterised by having, on both sides, a fringe or terrace of shingle and sand, rudely stratified and generally of considerable thickness. . . . No one fact in the geology of South America interested me more than these terraces of rudely-stratified shingle. They precisely resemble in composition the matter which the torrents in each valley would deposit, if they were checked in their course by any cause, such as entering a lake or arm of the sea; but the torrents, instead of depositing matter, are now steadily at work wearing away both the solid rock and these alluvial deposits, along the whole line of every main valley and side valley. It is impossible here to give the reasons, but I am convinced that the shingle terraces were accumulated during the gradual elevation of the Cordillera, by the torrents delivering, at successive levels, their detritus on the beach-heads of long narrow arms of the sea, first high up the valleys, then lower and lower down as the land slowly rose. If this be so, and I cannot doubt it, the grand and broken chain of the Cordillera, instead of having been suddenly thrown up, as was till lately the universal, and still is the common opinion of geologists, has been slowly upheaved in mass, in the same gradual manner as the coasts of the Atlantic and Pacific have risen within the recent period. A multitude of facts in the structure of the Cordillera on this view receive a simple explanation."

Investigations on Vesuvius

At the Royal Society on March 19, 1835, Daubeny read a paper entitled "Some account of the Eruption of Vesuvius, which occurred in the month of August 1834, extracted from the manuscript notes of the Cavaliere Monticelli, Foreign Associate of the Geological Society, and from other sources; together with a Statement of the Products of the Eruption, and of the Condition of the Volcano subsequently to it". After the eruption, the author had descended twice into the crater, which then presented a comparatively level surface, its sides consisting of strata of loose volcanic sand and rapilli, coated with incrustations of common salt, coloured red and yellow by peroxide of iron. The vapours which issued from the various parts of the surface, collected and condensed by means of an 'alembic' introduced into the ground, were found to consist principally of steam and muriatic acid, with only a slight trace of sulphurous or sulphuric acids. The author considered that carbonic acid was also exhaled, but neither nitrogen nor sulphuretted hydrogen appeared to form any part of the gas emitted.

The London and Greenwich Railway

In a note in its issue of March 21, 1835, the *Mechanics' Magazine*, referring to the London and Greenwich Railway, the first railway running out of London, said, "the Greenwich Railway will certainly not be ready to take passengers to the fair on Easter Monday, although according to some sanguine expectants, it was to be ready for that purpose two years ago. It is still progressing, however, and some of its arches have now made their appearance at the London Bridge end of the line, close to Tooley-street. It is understood that a locomotive will ply at Easter, for the conveyance of passengers on that part already completed; of course, such a trip will be taken more for the gratification of curiosity than for the sake of utility. A plan has been broached for erecting a landing place for steamers at Deptford, in connexion with the railway. . . . The success of such a speculation, however, is problematical. In nearly the same time that it would take steam-vessel passengers to land at Deptford, and get seated 'all right' in the railway carriages, they might by going on in the steamer, be at the end of their voyage; and could the transference be effected with even instantaneous rapidity, the railway carriages could not land passengers in the city, as the steamers now do, but in Tooley-street, Southwark, a good quarter of a mile away". As originally planned, the railway had 878 arches, and alongside the line was to be a tree-shaded road, a parade for invalids and children "incomparably superior to the boulevards of Paris".

Societies and Academies

LONDON

Royal Society, March 7. C. T. R. WILSON and J. G. WILSON: On the falling cloud-chamber and on a radial-expansion chamber. The advantages of removing a cloud-chamber from a confined space such as that between the poles of a magnet by letting it fall, and photographing the tracks while the chamber is falling freely, are pointed out. A new type of cloud-chamber, which has the form of a shallow cylinder with plane glass ends and in which the motion of the air during expansion is radial, gives good results. It is found, as anticipated, that dropping the cloud-chamber and photographing while it is falling freely enables undistorted track pictures to be obtained (by eliminating gravity) when the interval between expansion and illumination is prolonged to such an extent, that with the cloud-chamber stationary, distortion by convection currents has become serious. P. I. DEE and C. W. GILBERT: The transmutation of heavy hydrogen investigated by the cloud track method. The $_2He^3$ nuclei produced in the reaction

$$_1H^2 + _1H^2 \rightarrow _2He^3 + _0n^1$$

have been detected in the expansion chamber by passing a beam of artificially accelerated $_1H^2$ ions into a gas mixture containing heavy hydrogen. The range of this group of particles has been measured and is $4{\cdot}3 \pm 0{\cdot}2$ mm. for zero bombarding energy. The neutrons produced in the same bombardment have an energy of $1{\cdot}8 \pm 0{\cdot}2 \times 10^6$ electron volts. These results are in agreement with the application of the conservation of momentum to the process assumed. A value of $1{\cdot}0080 \pm 0{\cdot}004$ is thereby deduced for the mass of the neutron.

PARIS

Academy of Sciences, January 28 (*C.R.*, **200**, 357–428). JEAN TILHO: Some geographical peculiarities of the new Franco-Italian frontier between French Equatorial Africa and the Tripolitaine. Suggestions that in drawing the new frontiers sufficient regard has not been paid to geographical details. LOUIS DE BROGLIE: A remark on the interaction between matter and the electromagnetic field. CHARLES ACHARD and MAURICE PIETTRE: Researches on the protein of the hepatic tissue. Description of results obtained by the application of a new process, in which the pulp mixed with water is projected in a very fine stream against a polished surface cooled to $-30°$ C. WILLIAM BOWIE: The support given to geodesy by the Government of the United States of America. ALBERT FRANCIS BLAKESLEE was elected *Correspondant* for the Section of Botany, in succession to the late R. Chodat. MAURICE FRÉCHET: The general solution of Chapman's equation. JACQUES DELSARTE: Application of the theory of mean periodic functions to the solution of the equations of Fredholm-Nörlund. P. J. MYRBERG: The representation of automorph functions belonging to groups of genus zero. GÉRARD PETIAU: The matrices of the theory of the photon. PIERRE MASSÉ: Various problems on the limits of the theory of intumescences. DANIEL BARBIER, DANIEL CHALONGE and ETIENNE VASSY: The spectro-photometric study of the short wave-length radiation of some stars. A description of experiments carried out at the Jungfraujoch Observatory. Measurements were made mainly on stars of types *A* and *B* for wave-lengths between 4500 and 3100 A. CLAUDE CHARMETANT: The electrolysis of zinc chloride in solution in mixtures of water and ethyl alcohol. The effects of varying proportions of alcohol and of different current densities have been studied. PIERRE JACQUET: The mechanism of the action of certain colloids in electrolytic baths. PIERRE JACQUINOT: The fine structure of the components in the Paschen-Back effect in multiplets. ION I. AGARBICEANU: The magnetic weakening of the fluorescence of Te_2 and S_2. CHARLES DHÉRÉ and MLLE. ANNE RAFFY: The fluorescence spectra of rubene (tetraphenylrubene) in benzene solution and in the solid state. Two reproductions of spectrographs are given. R. AUDUBERT and C. REITHMULLER: The spectral sensibility of photo-electric counters. LÉONARD SOSNOWSKI: The artificial radio-activity excited in gold and the complexity of its radiation. F. FRANÇOIS: The system antimony iodide, potassium iodide, water. JEAN BUREAU: The diagram potassium nitrite—water. The hydrate KNO_2, $0{\cdot}5H_2O$. MARIO PICON: The action of heat on some metallic campho-carbonates. CLÉMENT DUVAL: Can cobalt have a co-ordination number eight? The author, repeating the experiments of K. Matsuno, has been unable to confirm his experimental results and regards his conclusions as doubtful. MARCEL MATHIEU: The structure of trinitrocellulose. Discussion based on X-ray measurements. L. PALFRAY and S. SABETAY: The application of the Cannizzaro reaction to the fatty and arylfatty series. ROBERT TRUFFAULT: The polymerisation of cyclohexene in the presence of phosphoric anhydride. CHARLES PRÉVOST: The synthesis of one of the dihydroanthranediols. JEAN GRARD: The nitration of starch. Nitrating starch by a modified method gave a product containing 11·5–12·5 per cent nitrogen. This is less stable than nitrocellulose and differs from the latter in its properties. PIERRE CHATELAIN: The measurement of the refractive indices of para-azoxyphenetol in the state of anisotropic liquid. HUBERT GARRIGUE: The radioactivity of air in the mountains. HENRI GESLIN and JEAN SERVY: An index characterising dryness from the agronomic point of view. W. KOPACZEWSKI: The jellying of proteins by acids. LAZARE SILBERSTEIN: The chemical composition of bone. The case of the femur of the horse. LUCIEN PLANTEFOL and GEORGES CHAMPETIER: The action of heavy water on the germination of pollen. Comparative study of the germination of pollen grains by ordinary and heavy water. There are marked differences, but heavy water cannot be regarded as toxic to the pollen.

CRACOW

Polish Academy of Science and Letters, January 7. W. JACYNA: Action at close quarters and action at a distance in the characteristic equation of thermodynamics. W. JACYNA: The principle of the predominating influence in the characteristic equation of thermodynamics. K. DZIEWONSKI and M. OTTO: Study on α-methylnaphthalene. MLLE. J. WOLOSZYNSKA: The algæ of the lakes and marshes of the Tatra. Two Gymnodinians of the lakes 'Morskie Oko' and 'Czarny Staw pod Rysami'. J. TUR: Researches on the embryonic neoplasmoids. L. W. WISNIEWSKI: *Cercaria dubia*, and its evolution in *Herpobdella atomaria*. ST. MARKOWSKI: The evolutive cycle of *Bothriocephalus scorpii*.

COPENHAGEN

Royal Danish Academy of Science and Letters, November 2. NIELS BOHR: On the applicability and limitation of the methods of classical physics in the description of collision and radiation processes.

November 30. L. KOLDERUP ROSENVINGE: Distribution of the Rhodophyceæ in Danish waters. Statistical investigations on the distribution of the Danish Rhodophyceæ show that the number of species decreases greatly from the northern Kattegat to Bornholm. The species dominant in the south, which are, however, common in the northern districts, decrease more rapidly, with the consequence that the northern species are more numerous than the southern in the intermediate zones. ØJVIND WINGE: Experimental alteration of sex chromosomes into autosomes and vice versa, as illustrated by *Lebistes*. The common view concerning the distribution of the sex-determining elements in the sex chromosomes and the autosomes is incorrect. Female, as well as male, genes are present in the autosomes, and by systematic selection of male or female autosomal genes the sex may be changed. In the experimentally produced *Lebistes* race in which both sexes have XX, 50 per cent of each sex are born in the spring, while nearly 100 per cent of females are born during autumn and winter, the external conditions having some influence upon sex determination in this race. Besides normal XX females and XY males, the following types have been produced: XX males, XY females, and YY males. By crossing the XX males to normal females, all the offspring will be female, while YY males give only male offspring when crossed to normal females. XY females crossed to normal XY males give males and females in the proportion 3 : 1, as expected. The male-determining element in the Y-chromosome is at one end. The gene contents of the sex chromosomes have been partly mapped out.

WASHINGTON, D.C.

National Academy of Sciences (*Proc.*, 20, 601–681, Dec. 15, 1934). T. E. STERNE: The accuracy of least squares solutions. (2) The standard deviation of the errors of linear equations of condition. MARGARET B. SILER: Chromosome numbers in certain Ricciaceæ. Two basic numbers are found, 8 and 9; these include one chromosome very much smaller than the remainder. HENRY E. MERRIAM and JOHN E. RUTZLER, JR.: Reversible coagulation in living tissue (13). Caffeine increases the reflex excitability of the central nervous system from above downwards, and it causes insomnia. It can be counteracted by an appropriate dose of sodium rhodanate. G. A. LEBEDEFF: Genetics of hermaphroditism in *Drosophila virilis*. The third chromosome recessive gene (intersex) causes reversion of homozygous females to sterile males. Modifiers determine the time when this gene becomes active and hence the degree of hermaphroditism. C. W. METZ and E. H. GAY: Organisation of salivary gland chromosomes in *Sciara* in relation to genes. These chromosomes shows 'bands' or 'discs' causing striations similar to those observed in the salivary gland cells of Diptera. The strain of *Sciara* used shows regularly one particular 'vesicle' extending only half-way round the chromosome. Observation of fixed and living material suggests that, in the region of this 'vesicle', the two component chromosomes are not fused to form a cylinder, but lie side by side. The 'vesicles' or 'segments' of different regions differ slightly and seem to be the 'chromioles' thought by Belling to represent genes. W. E. CASTLE: Body size of reciprocal hybrids in rabbit crosses. If chromosomal genes alone function in the genetic determination of body size, then reciprocal crosses between pure races of different size should give identical results. In such crosses between a large and three smaller races of rabbits, the offspring of large female mated with small male are, however, significantly larger than those of small female crossed with large male. CHESTER STOCK: A Hypertragulid from the Sespe Uppermost Eocene, California. W. W. COBLENTZ and R. STAIR: Ultra-violet transmission changes in glass as a function of the wave-length of the radiation stimulus. Soda-lime-silica and soda-silica glasses show stages in photo-chemical equilibrium which are different for each wave-length of homogeneous radiation to which the glass reacts, and the soda seems to be the sensitive constituent. To attain each stage of equilibrium, transmission may increase or decrease, according to the history of the specimen. For wave-length 254 $m\mu$ and shorter, depth of penetration is small; for wave-length 365 $m\mu$ and longer, penetration is deep. The shortest and the longest wave-lengths used had the greatest photo-chemical effects, namely, in depreciating and appreciating respectively the transmission of a soda-lime-silica glass. J. L. SYNGE: On the expansion or contraction of a symmetrical cloud under the influence of gravity. A discussion employing invariant equations consequent on the usual field equations. JOSEPH HALL BODINE: To what extent is developmental block dependent upon the metabolic activity of the embryonic cell? By immersing grasshopper eggs showing developmental block in hypertonic balanced salt solutions, it is shown that the block is not primarily dependent on the general oxidative metabolism and indeed that the oxygen consumption rate itself is a result of the block. SELIG HECHT: A theoretical basis for intensity discrimination in vision. Photo-reception requires (*a*) an inactive photo-sensitive substance which absorbs light and is changed by it into an active substance responsible for the nerve impulse; and (*b*) a mechanism for maintaining the supply of sensitive substance. Equations are developed describing such a photo-chemical system, and they give curves which fit the experimental results for *Drosophila*, the bee, the clam and the human eye. Contrary to earlier results, it is found, in accordance with this theory, that $\triangle I/I$ (where I is intensity), after decreasing rapidly with increase of I, reaches a constant low value and does not rise again after passing through a minimum. J. S. NICHOLAS and DOROTHEA RUDNICK: The development of rat embryos in tissue culture. The medium used was heparinised rat plasma plus rat embryonic extract. Embryos of presomite to early 5–7 somite stages were observed up to 72 hours after explantation. Growth and differentiation occur, but in 48 hours are one half and three quarters respectively of that of controls. L. H. KLEINHOLZ: Eye-stalk hormone and the movement of distal retinal pigment in *Palæmonetes*. Eye-stalks of this shrimp stimulated by light secrete a hormone causing inward migration of distal pigment cells; no substance of opposite action appears in the dark, so that the outward movement of the pigment cells appears to be inherent in the pigment cells themselves. B. KAUFMANN and

H. D. URSELL: The dissection of closed surfaces and the Phragmen-Brouwer-Alexandroff theorem. WILLIAM W. FLEXNER and MADELINE LEVIN: The intersection of arbitrary chains and its boundary. W. J. TRJITZINSKY: The general case of linear integro-differential equations. JOHN L. VANDERSLICE: Conformal tensor invariants. A. ADRIAN ALBERT: Involutorial simple algebras and real Reimann matrices.

Forthcoming Events

[*Meetings marked with an asterisk are open to the public.*]

Sunday, March 17

BRITISH MUSEUM (NATURAL HISTORY), at 3 and 4.30.—M. Burton: "Myths of the Countryside".*

Monday, March 18

BRITISH MUSEUM (NATURAL HISTORY), at 11.30.—Dr. Hugh Scott: "Insect Collecting in Abyssinia".*

BRITISH PSYCHOLOGICAL SOCIETY (INDUSTRIAL SECTION), at 6.—Dr. Jose Germain: "Industrial Psychology in Spain".

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Lieut.-Col. R. B. Seymour Sewell: "The Floor of the Arabian Sea".

Tuesday, March 19

BRITISH INSTITUTE OF PHILOSOPHY, at 8.15.—(at University College, Gower Street, London, W.C.1).—Sir Josiah Stamp: "Can Present Human Motives Work a Planned Society?".*

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.30.—(at the London School of Hygiene and Tropical Medicine, Keppel Street, W.C.1).—Film of "The Worora Tribe of N.W. Australia: Technology and Ceremonies"; comments by Rev. J. R. B. Love.

"Stonehenge and its Problems"; comments by Gerald Heard.

Wednesday, March 20

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Dr. F. J. W. Whipple: "The Propagation of Sound to Great Distances" (G. J. Symons Memorial Lecture).

ROYAL SOCIETY OF ARTS, at 8.—Wing Commander T. R. Cave-Browne-Cave: "Exhaust Noise and the other Noises of Motor Transport".

Thursday, March 21

CHEMICAL SOCIETY, at 8.—Discussion on "Recent Progress in the Chemistry of the Terpenes", to be opened by Prof. J. L. Simonsen.

Friday, March 22

QUEEN MARY COLLEGE, at 5.30.—Prof. E. K. Rideal: "Some Problems in Surface Action".*

INSTITUTION OF PROFESSIONAL CIVIL SERVANTS, at 5.30.—(at the Royal Society of Arts, John Street, Adelphi, W.C.2).—Prof. H. Levy: "Science and Social Responsibility".*

BRITISH SCIENCE GUILD AND THE GEOGRAPHICAL ASSOCIATION, at 7.30.—(at the College of Technology, Manchester).—Comm. L. C. Bernacchi: "Antarctic Exploration, Past and Present".*

ROYAL INSTITUTION, at 9.—Prof. B. Melvill Jones: "Speed".

Official Publications Received

GREAT BRITAIN AND IRELAND

Proceedings of the Fourth International Congress for Applied Mechanics, Cambridge, England, July 3rd–9th, 1934. Pp. xviii+283. (Cambridge: Printed at the University Press.)

Technical Publications of the International Tin Research and Development Council. Series A, No. 7: The Determination of the Porosity of Tin Coatings on Steel. By D. J. Macnaughton, S. G. Clarke and J. C. Prytherch. Pp. 9+3 plates. Series A, No. 14: Tinplate, some Fundamental Considerations. By W. E. Hoare. Pp. 16+4 plates. Series D, No. 1: A Study of the Yellow Stain on Tinplates. By C. E. Beynon and C. J. Leadbetter, under the supervision of Prof. C. A. Edwards. Pp. 11+4 plates. (London: International Tin Research and Development Council.)

Reports of the Progress of Applied Chemistry. Issued by the Society of Chemical Industry. Vol. 19, 1934. Pp. 840. (London: Society of Chemical Industry.) 12*s.* 6*d.*; to Members, 7*s.* 6*d.*

College Hall, London (University of London). Fifty-second Annual Report, September 1st, 1933–August 31st, 1934. Pp. 48. (London: College Hall.)

OTHER COUNTRIES

New South Wales: Department of Mines: Geological Survey. Mineral Resources, No. 36: West Darling District; a Geological Reconnaissance with Special Reference to the Resources of Subsurface Water. By E. J. Kenny. Pp. 180+15 plates. (Sydney: Government Printer.) 6*s.*

Smithsonian Miscellaneous Collections. Vol. 92, No. 14: Archeological Investigations in the Bay Islands, Spanish Honduras. By William Duncan Strong. (Publication 3290.) Pp. vi+76+33 plates. (Washington, D.C.: Smithsonian Institution.)

India: Meteorological Department. Scientific Notes, Vol. 5, No. 60: A Study of the Atmospheric Horizontal Visibility at Bangalore. By A. Ananthapadmanabha Rao. Pp. 141–157+3 plates. (Delhi: Manager of Publications.) 10 annas; 1*s.*

Commonwealth of Australia: Council for Scientific and Industrial Research. Pamphlet No. 51: The Chemistry of Australian Timbers. Part 4: A Study of the Lignin Determination, II. By W. E. Cohen. (Division of Forest Products, Technical Paper No. 14.) Pp. 20. (Melbourne: Government Printer.)

Transactions of the National Institute of Sciences of India. Vol. 1, No. 1: Physiology, Bionomics and Evolution of the Air-Breathing Fishes of India. By Dr. S. L. Hora. Pp. 16+1 plate. (Calcutta: National Institute of Sciences of India.)

U.S. Department of Agriculture. Technical Bulletin No. 455: The European Corn Borer and its Controlling Factors in the Orient. By Charles A. Clark. Pp. 38. (Washington, D.C.: Government Printing Office.) 5 cents.

Proceedings of the Boston Society of Natural History. Vol. 40, No. 4: On the Habits and Distribution of Birds on the North Atlantic. By V. C. Wynne-Edwards. Pp. 233–346+plates 3–5. (Boston, Mass.: Boston Society of Natural History.)

U.S. Department of the Interior: Office of Education. Bulletin, 1933, No. 2: Statistical Summary of Education, 1931–32. Prepared by Emery M. Foster. Pp. 12. 5 cents. Bulletin, 1934, No. 8: Supervision exercised by States over Privately Controlled Institutions of Higher Education. By John H. McNeely. Pp. v+64. 10 cents. (Washington, D.C.: Government Printing Office.)

Madras Fisheries Department. Administration Report for the Year 1933–34. By Dr. B. Sundara Raj. Pp. iii+83+3. (Madras: Government Press.) 12 annas.

Jac. Berzelius Brev. Utgivna av Kungl. Svenska Vetenskapsakademien genom H. G. Söderbaum. Supplement utgivet genom Arne Holmberg: Brev från Berzelius till Thomas Thomson och till Alexandre Brongniart. Pp. 24. (Uppsala: Almquist and Wiksells Boktryckeri A.-B.)

Smithsonian Institution: Unites States National Museum. Report on the Progress and Condition of the United States National Museum for the Year ended June 30, 1934. Pp. iii+109. (Washington, D.C.: Government Printing Office.) 15 cents.

Smithsonian Miscellaneous Collections. Vol. 93, No. 2: Mud Shrimps of the Atlantic Coast of North America. By Waldo L. Schmitt. (Publication 3292.) Pp. 21+4 plates. Vol. 93, No. 5: Nomenclature of some Cambrian Trilobites. By Charles Elmer Resser. (Publication 3295.) Pp. 46. (Washington, D.C.: Smithsonian Institution.)

The Museum Journal. Vol. 24, No. 1: Beth-Shan, Earliest Pottery, by G. M. Fitzgerald: Tell Billa, First Assyrian Level, by Charles Bache. Pp. 52. (Philadelphia: University Museum.)

Field Museum of Natural History. Zoological Series, Vol. 18, No. 12: New Fishes obtained by the Crane Pacific Expedition. By Albert W. Herre. (Publication 335.) Pp. 381–438. (Chicago: Field Museum of Natural History.) 50 cents.

Bulletin of the American Museum of Natural History. Vol. 67, Article 9: Catalogue of Mineral Pseudomorphs in the American Museum. By Clifford Frondel. Pp. 389–426. (New York City.)

U.S. Department of the Interior: Office of Education. Vocational Education Bulletin No. 172: Vocational Teacher Training in the Industrial Field. Pp. v+32. 5 cents. Vocational Education Bulletin No. 178: Teaching Farm Credit. Pp. vii+43. 5 cents. (Washington, D.C.: Government Printing Office.)

Proceedings of the United States National Museum. Vol. 83, No. 2973: American Muscoid Flies of the Genera Ceratomyiella and Paradidyma. By H. J. Reinhard. Pp. 9–43. (Washington, D.C.: Government Printing Office.)

The Medical and Scientific Archives of the Adelaide Hospital. No. 13 (for the Year 1933). Pp. 42. (Adelaide: Government Printer.)

Østers og østerkultur i Norge. Av Torbjørn Gaarder og Paul Bjerkan. (Utgitt med bidrag av Fiskeridirektoratet.) Pp. 96. (Bergen: A.-S. John Griegs Boktrykkeri.)

Bergens Museums Skrifter. Nr. 16: Norges Levermoser. Av E. Jørgensen. Pp. 344+25 charts. (Bergen: A.-S. John Griegs Boktrykkeri.)